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SCIENTIFIC AMERICAN

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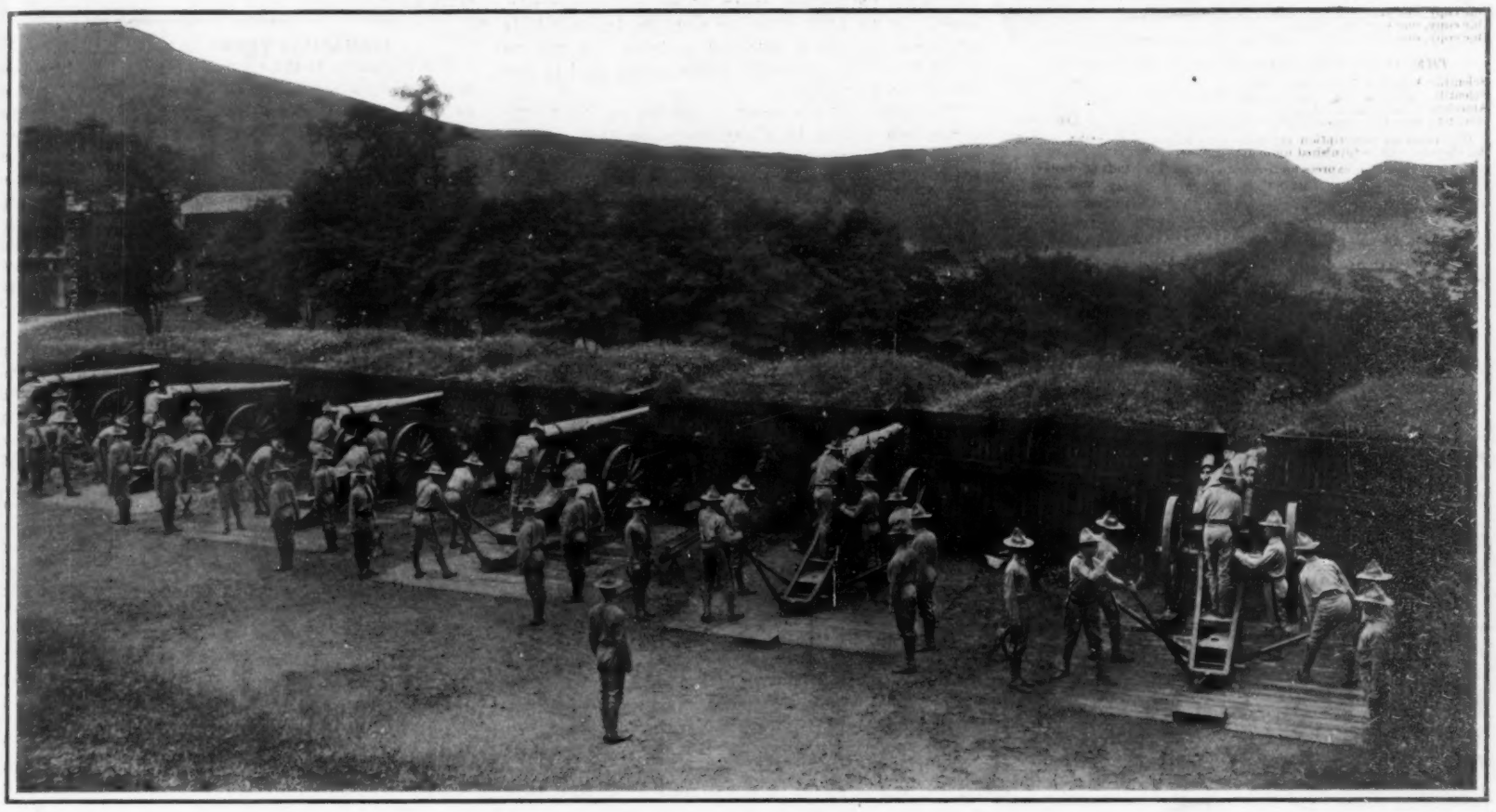
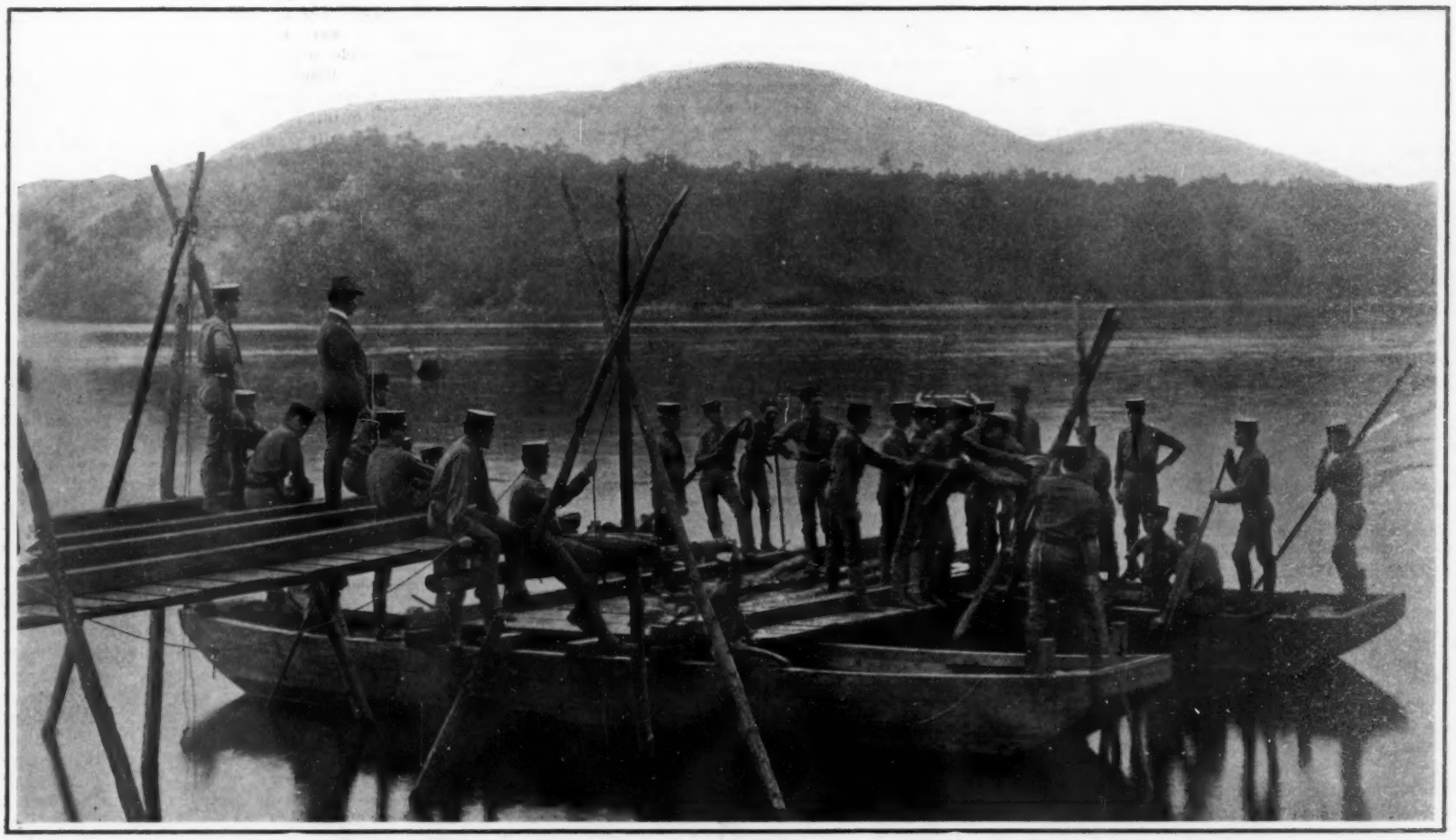


Siege Battery Drill on the Banks of the Hudson River.



Building a Trestle Bridge.

THE UNITED STATES MILITARY ACADEMY AT WEST POINT.—[See pages 186, 187, 188.]

SCIENTIFIC AMERICAN

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NEW YORK, SATURDAY, MARCH 14, 1908.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

CAUSE OF THE QUEBEC BRIDGE FAILURE.

According to a recent press dispatch from Ottawa, Canada, the report of the Royal Commission appointed to investigate the Quebec Bridge disaster has been presented to the Minister of Railways for the consideration of the Canadian Parliament. It is stated that the Commission does not find that the failure of the bridge was due to any defect in the materials, or in the manner in which the bridge was constructed; but that it fell because of errors in the design. The Commission considers that the engineers failed to recognize that the formulæ which are used in proportioning members of bridges of ordinary size require considerable modification before they can be safely applied in the design of such huge members as were found in the Quebec Bridge. If this statement of the findings of the Commission is correct, they agree closely with the opinion which we expressed at the time of the disaster. We still believe, however, that the initial point of failure occurred in the over-light latticing of the bottom chord; and that the determination of the proper weight and distribution of such latticing always has been, and is to-day, too largely theoretical. The whole question of the proper design of built-up posts, especially in large members, calls for thorough investigation, with a view to the provision of new and more reliable formulæ.

SECOND PENNSYLVANIA EAST RIVER TUBE FINISHED.

We recently recorded that the first of the four tunnel tubes which the Pennsylvania Railroad is driving beneath the East River had been put through. Another tube was completed last week, and the driving of the third tube will probably be finished by the time this issue is in the hands of our readers. The last tube of the four, which has encountered in its course below the river considerable rock, is not expected to be completed for another month. The rapidity with which these four tunnels have been driven has come as a considerable surprise to the general public—so many were the hindrances and setbacks encountered in the earlier stages of the work. The initial troubles arose from the unsatisfactory nature of the river bottom encountered by the contractors when the tunnels began to pass from under the shore and enter the deposits of the river bottom. Blowouts were frequent; and in order to prosecute the work by the compressed air method, it became necessary to load hundreds of tons of material upon the bed of the river above the tubes. The contractors, indeed, claim that on some stretches of the work they have practically formed a new river bottom.

EXTEMPORIZED JET PROPULSION.

The majority of the attempts to provide successful jet propulsion have failed because the delivery pipe was too small and the reaction insufficient. Such jet-propelled vessels as have proved successful have been provided with discharge pipes of generous area. A curious instance of successful propulsion by the reaction of a stream of water driven rearwardly from the stern of a vessel, was afforded some time ago in the case of one of the Bates suction dredges while it was being towed in quiet water. It occurred to the engineer on board that the progress of the dredge might be assisted if the big discharge pipe were lowered into the water astern and the centrifugal pumps started. This was done; and the experiment was so successful that on speeding up the pumps, the heavy barge ran up on the tug by which it was being towed. We understand that the hint thus given has been frequently followed in dredges of this character, and that the pumps are not only used for propelling the dredges under certain suitable conditions, but that it has been found possible, by swinging the discharge pipe to port or starboard, to steer the dredges and maneuver them into the desired position, thus obviating the necessity for a considerable amount of warping.

THE OCEAN MAIL BILL.

There is good reason to hope that the Ocean Mail Bill will be passed by the present Congress. By the terms of the bill the Postmaster-General is authorized to pay an additional amount for ocean mail service by vessels of the second class on routes to South America and to the Philippines, Japan, China, and Australasia, amounting to 4,000 miles or more in length. This additional amount is intended to bring the rate up to the four dollars per mile which is now paid to vessels of the first class.

The history of our merchant marine on the Pacific Ocean has proved to a demonstration that we are unable to compete with foreign-built-and-manned merchant lines. We have built fleets of vessels for passenger and freight service on this ocean, which were second to none in comfort, safety, and regularity of service. And yet we have seen these ships gradually forced off the various routes on which they were running, because of the utter impossibility of making them pay their way at existing rates. It is a fact that our merchant ships are being steadily driven from the Pacific Ocean. Of course, it may be argued that, since the field is not a profitable one for investment, the best thing the United States can do is to abandon it altogether. If this were merely a question of the profitable or unprofitable investment of capital, it would be of limited importance; but it is much more than that. The maintenance of an adequate merchant marine on the Pacific Ocean is a matter of prime national importance; for if we have no merchant marine to provide us, in the event of war, with auxiliaries and a recruiting field from which men may be drawn to man our fighting ships, the operations of our navy will be most seriously hampered, and its efficiency greatly impaired.

The cruise of our battleship fleet to the Pacific has placed us, as a nation, in a position which is decidedly humiliating. So greatly has our merchant marine declined, that it does not contain to-day a sufficient number of steam colliers to carry the necessary coal to enable our battleships to make the voyage from Hampton Roads to San Francisco. It is, indeed, a strange anomaly that this fleet of auxiliary ships, so necessary to the progress of the fleet, should be flying foreign flags and manned by subjects of other governments. Were we now at war with another nation, these foreign colliers could not, because of international law, be placed at our disposal. The Ocean Mail Bill is very modest in its provisions, and the military benefits which will accrue from its passage, in the provision of an adequately-manned merchant marine, available to the government in case of emergency, will be ample compensation for the financial assistance which is now asked of the government.

THE CROOKEDNESS OF THE HUDSON TUNNEL.

Considerable surprise has been expressed by people who have made the trip below the Hudson River, that the tunnels should contain so many jogs and curves in the alinement and such frequent undulations in the grade line. In certain sections the tunnel does certainly seem rather crooked for a system designed to carry dense traffic, in trains of considerable length, and running at fair speed. The most noticeable irregularity in the road, both in alinement and grade, occurs in the north tunnel after about three-fourths of the distance beneath the river has been traversed. Also in the section of the line from Fourteenth Street to the bulkhead line on the east shore of the river there are several rather sharp jogs, which look as though they might easily have been eliminated.

This crookedness is not to be taken as indicating any want of security or permanence in the tunnels, or any carelessness in keeping them during construction to proper grade and alinement. The stretch of undulating and curving line in the north tunnel near the Hudson shore occurs in the old brick tunnel, which was built in the early eighties under Mr. Haskin. By reference to the SUPPLEMENT of February 29, in which the method of building this portion of the line is shown, it will be seen that it was built without the use of the shield, the compressed air being relied upon to keep the silt from crowding in on the work. The brickwork of the tunnel was built within a shell of light 3/16-inch plates; and as this shell had no strength to resist distortion, the plates were frequently thrown out of the true circle, sometimes the roof and floor and sometimes the sides being bulged in. The completed brick tunnel, of course, had to take the shape of the shell, and hence the irregularity which is now noticeable in that part of the tunnel. After the shield was introduced, the remaining portion of the tunnel was pushed through on its true lines. The southerly tunnel also runs remarkably true to alinement and grade. The curvature in that portion of the line lying beneath Manhattan Island is due to the fact that the Rapid Transit Commission granted a franchise for the construction of the tunnel immediately below the streets and within the building lines; and it was the necessity of following the street line and avoiding encroachment on private property that produced much of the curvature above referred to. Where the engineers had a free hand, the alinement and grade are remarkably correct, and the great curves at Fifteenth Street, Jersey City, and at Morton Street, New York, are fine examples of the accuracy with which the instrumental work in these tunnels has been carried out.

SUBMARINES VERSUS BATTLESHIPS.

The battleship is the unit of strength by which one nation judges the power of another nation. It was so in the days of the wooden three-decker, when the decisive engagements were fought out by big ships, able to lie in the line and give and take the hard knocks of a fleet engagement. It is so to-day, more even than in the days of sail power and smooth-bores; and the battle of the Sea of Japan gave tragic demonstration of the unalterable fact, which for many years had been well known to naval men, that the final issue of a naval campaign must be fought out, broadside to broadside, between big ships clothed with heavy armor, and mounting the most powerful long-range guns.

Periodically there has appeared the advocate of some cheap instrument or method of attack and defense, who proposed the building, in large numbers, of some kind of speedy "kill-all," with which to sweep the mighty armaments of the leading naval powers from the seas. Such theorists had their say, and had their day; creating no little stir for the time being, and not infrequently causing a lavish outlay of money that might have better been expended in the construction of serviceable seagoing ships. The torpedo, at its first successful introduction, was heralded as "sounding the death knell of the battleship"; and the pneumatic dynamite gun, coming a few years later, was announced as certain to accomplish what the torpedo had failed to do. To-day it is the submarine to which many half-informed enthusiasts are pinning their faith as being certain to drive the big battleship from the high sea.

The history of naval development shows that each of these inventions, when it came to be put to the test of actual service, was rapidly shorn of its terrors and relegated to its proper subordinate sphere. While we have no wish to decry the usefulness of the submarine in its proper and very limited field of action, we do not hesitate to assert that in its present condition it has not emerged from the purely experimental stage; that it is a delicate and capricious instrument of war, which, because of its uncertain action, is liable to prove only less dangerous to friend than to foe. Undoubtedly, the submarine is capable of being greatly improved in reliability, speed, and vision; but in this last respect it is so defective, being, indeed, practically blind when submerged, that a vast amount of work has yet to be done to render it a practical weapon, that can be relied upon to fulfill its particular functions with as much certainty as the battleship, cruiser, fast scout, or torpedo-boat destroyer.

Modern naval operations tend more and more toward the open sea. Costly battleships, valued at $10,000,000 apiece, will never again attempt the perilous task of entering mined harbors, or coming within range of seacoast guns and mortar batteries. The issues of future naval wars will be determined in great fleet engagements between battleships upon the high seas, where the submarine will not care to venture, and where, in the more or less agitated water, its periscopes will be wave-washed and salt-encrusted, and the submerged craft be rendered as blind as a bat.

With these facts in mind, the recent action of the House Naval Committee in substituting four submarines for two of the battleships asked for by the Navy Department, presents itself as one of the latest and most flagrant instances of lay interference with a strictly professional problem. If the House Naval Committee has its way, the country will find itself in the possession of four units of very doubtful value in place of two units whose value has been proved again and again, units which have been accepted by all the navies of the world as the one supreme test of naval power. If the Naval Committee made the substitution with a view to decreasing the cost of the total appropriation of the navy, it should have said so. But since there has been no hint of this, we are forced to the conclusion that the committee considers that four submarines are equal in military value to two 20,000-ton battleships. As a matter of fact, neither four nor forty submarines would approach in fighting value the two "Dreadnoughts" which the Naval Committee would throw out of the bill.

As to the ugly rumors that extensive lobbying has

been done by certain interested submarine builders in the endeavor to increase the appropriation for vessels of this class, we can only say that if any attempt has been made to bribe our legislators, we hope that it will be thoroughly exposed, and the guilty party visited with the severest penalty that the law can impose. It is rather the province of the SCIENTIFIC AMERICAN to look at this matter from the technical side; and, in closing, we cannot do better than to point to the French government as a notable example of the folly of pursuing the submarine fad to the neglect of battleship construction. For some years the interest of the French Navy Department was centered in the submarine, in the belief that this craft was to be the weapon of the future. To-day, however, the French government have entirely come around to the point of view of the British and our own Navy Departments; and they are devoting the majority of their appropriations to the construction of big battleships carrying only the heaviest armor-piercing guns.

AN INTERNATIONAL LIFE-SAVING CONGRESS.

The first international congress of persons interested professionally and otherwise in life saving will meet at Frankfort on the Main in the first week of June, and will afford an opportunity hitherto lacking for the interchange of views, plans, and experiences among life-saving and fire departments of cities, railways, vessels, mines, factories, etc., for the purpose of preventing the repetition of costly and disastrous errors of omission and commission. It will also formulate preventive regulations, and discuss prompt measures of relief. In short, the congress will devote itself to *practical* improvements in the saving and safeguarding of life, thus extending over a wider field the work of the German Samaritan League. Count von Posadowsky, the German Home Secretary (Staatssekretär des Innern), Prof. von Esmarch, and Prof. Moritz Schmidt are honorary presidents, respectively, of the congress, the general committee, and the committee of organization. Addresses may be delivered and discussions conducted in German, French, or English. Papers should have been entered by October 1, 1907, and submitted by January 1, 1908, but belated papers may be admitted with the consent of the section interested. National and local governments and all corporations, institutions, and associations interested in the saving of life are invited to send delegates. A member's card, entitling the holder to a copy of the published proceedings, costs 20 marks ($5); a lady's card, without the proceedings, costs 10 marks ($2.50).

All communications should be addressed to the Internationaler Kongress für Rettungswesen, Leipzig, Nikolaikirchhof, 2.

The congress will hold two general meetings, but its most important work will be done in the sessions of its ten sections, to which the following subjects are assigned:

Section 1. First Aid by Physicians in Accidents.—Scope and limits of first aid. Voluntary and legally required service. Statistics. Training and methods. Improved appliances. Theoretical and practical courses. Literature.

Section 2. First Aid by Others than Physicians.—Training of police, firemen, railway and postal employees, foremen, etc. Practice courses. Improved appliances. Accident kits. Credentials and examinations. Courses in schools and factories. Courses for women in nursing and life-saving work.

Section 3. Life-Saving Service in Cities.—General organization, hospitals, duties of authorities and physicians. Accident, sanitary, and appliance stations. Central stations and signal service. Transportation of patients. Precautions against contagion. Disinfecting stations. Regulation of assemblies. Organization of corps for conflagrations, etc. Sanitary police. Collection of statistics.

Section 4. Life-Saving Service in Factories, Small Towns, and the Country.—Duties of authorities, hospitals and benevolent societies. Voluntary aid. Health camps. Rural fire companies. Signal service, bicycle stations, appliance stations. Character and frequency of accidents. Farm machinery. Transportation of patients. Safety regulations. Factory physicians. Disinfection. Instruction by traveling lecturers, etc.

Section 5. Life-Saving Service in Land Traffic.—Organization, signal service, appliances. Character of injuries. Hospital trains and improvised railway hospitals. Training of employees. Contagion and disinfection. Accidents in trolley, automobile, bicycle, and other traffic.

Section 6. Life-Saving Service on Vessels, in Inundations, etc.—Equipment of ocean vessels. Ships' surgeons. Coast guards, beacons, and lifeboats. River, lake, and harbor vessels. Collisions and fire. Inundations. Water patrol. Bathing resorts. Training of rowing, yachting, and swimming clubs. Rescue and resuscitation of drowning persons.

Section 7. Life-Saving Service in Mining and Allied Industries.—Most frequent accidents in mines. First aid, signal service, conveyance to the surface and medical care. Appliance stations. Fire damp and dust explosions. Preventives. Rescue corps and equipment. Asphyxiation and inundation. Tunnel and caisson work, their dangers and diseases.

Section 8. Life-Saving Service in Fire Companies.—Training and practice. Department physicians. Asphyxiation, electric shocks, apparent and real death. Oxygen apparatus. Equipment of firemen in general life-saving service. Volunteer fire companies.

Section 9. Life-Saving Service in the Mountains.—Causes and nature of accidents. Exhaustion, snow blindness, cold, lightning, avalanches. Training of guides in first aid, signal service, road maps, stations. Restoratives for sudden illness. Rescue and transportation. Rescue from crevasses in glaciers. Instruction in mountain dangers. Effects of rarefied air, mountain sickness. Statistics of accidents.

Section 10. Life-Saving in Connection with Sport.—Exhaustion, its consequences and their prevention. Medical advice in training. Accidents in various sports. Sunstroke and heat prostration. Signal service, stations, and attendants. Training of athletic clubs in first aid, etc.

RADIOGRAPHY IN PEARL FISHING.

The products of the sea are commonly wasted to a very deplorable degree by those who gather and use them. In no instance is this waste more marked than in the search for pearls. By the old method, which is still in vogue as a general rule, an enormous number of the so-called oysters are taken from their habitat and destroyed without any thought of economy. It is said that only one pearl is found in 100 oysters, and only one per cent of the pearls found are of any commercial value. Thus some 10,000 of the precious mollusks are sacrificed for every useful pearl obtained. Among these victims there must be a vast amount of immature pearls or seeds, pearls *in posse*, which might grow and become valuable gems, which are deprived of that possibility by premature destruction.

In the year 1901 Prof. Raphaël Dubois took radiographs of pearls *in situ* within the shell of *Unio prolifera*, and obtained a clear view of their size and situation in spite of the thickness of the shell in which they were incased. He showed these radiographs at the Linnean Society of Lyons, and remarked that the X-rays might receive a novel application if used in the fisheries of Ceylon, and the destruction of a vast number of the prized mollusks might thus be avoided.

The difficulty of applying the X-rays to many thousands of shells *per diem* seemed sufficient to deter the ordinary person from such a laborious attempt. However, a few years later an electrical engineer of New York, Mr. John J. Solomon, who took an interest in the question of pearls, was struck by the same idea of using the X-rays to detect the existence of pearls within the shell of the living animal. He was then unaware of the earlier experiments of Prof. Dubois, but promptly set himself about the work from a commercial point of view.

In reviewing his work, Nature states that he found that an exposure necessary to obtain a good picture did not in any way injure the animal, and even an exposure of ten times as long could be applied harmlessly. The dangers lay rather in the removal of the bivalve from its normal attachment and in the time required for its transit from its bed to the laboratory of the photographer; for the pearl oyster is really a kind of mussel, which holds onto some fixed object by a brush of fibrils (*byssus*) growing from its body.

Thus the fundamental principle of Prof. Dubois, to save the life of unremunerative bivalves, bids fair to be carried out by American ingenuity and capital.

For practical purposes, where many thousands of shells have to be radiographed daily, a completely novel kind of plant had to be devised. This was done, and final success was considered to be well in view, when one hundred clear radiographs could be taken on an average every fifteen seconds. Mr. Solomon often succeeded in taking as many as five hundred per minute. In this process some hundred shells are exposed at a time to the rays. The oysters, spread on trays, are carried under the specially constructed cylinders by means of an electric motor. These great cylinders are cooled by means of suitable water jackets, and can thus be kept working continuously.

The oysters in which there is no sign of pearl formation are put back to their beds. Those in which good-sized pearls are detected are removed and opened, and the pearls promptly utilized. Those showing no pearls of adequate commercial value, but containing promising seed or immature pearls, are carefully placed in hospital. This hospital has rather a novel object; not the cure of the pearl disease (for the much prized gem is but a pathological growth), but, on the contrary, everything is done to keep the mollusk in *statu quo ante* so that the disease may progress as rapidly as possible to the production of valuable pearls and to the death of the incurable patient.

The question seems to arise, can the normal, or perhaps we should say, the abnormal, conditions of the pearl-producing bivalve be well enough imitated in captivity to insure the continued growth of the pearls? May not the "change of water" (as they must be kept nearer the surface) secure for the sufferers immunity from their diseased process? One might have imagined that a greater amount of sunlight, more oxygen, altered temperature, different nutrition, lessened pressure, and other changed conditions we think not of, would so influence the life of the mollusk that it might depart from its pathological but useful habit of producing these valued round bits of shell material, and the hospital might thus become a true *Kur-Anstalt* instead of a pearl-breeding depot. But Mr. Solomon tested these points, and he has satisfied himself that, if he can be certain to transmit in all circumstances the oysters to and from his laboratory without injury to their well-being, all other difficulties have already been overcome. As to the lucrative commercial value of the undertaking, time alone can tell; sufficient has not yet elapsed to make it demonstrable by actual proof that pearls can thus be hatched *en gros*.

OFFICIAL METEOROLOGICAL SUMMARY, NEW YORK, N. Y., FEBRUARY, 1908.

Atmospheric pressure: Highest, 30.80; lowest, 29.15; mean, 30.80. Temperature: Highest, 56; date, 15th; lowest, 1; date, 5th; mean of warmest day, 48; date, 15th; coolest day, 12; date, 4th; mean of maximum for the month, 35; mean of minimum, 21.2; absolute mean, 28.1; normal, 30.6; deficiency compared with mean of 38 years, —2.5. Warmest mean temperature of February, 40, in 1890. Coldest mean, 23, in 1875 and 1885. Absolute maximum and minimum for this month for 38 years, 69 and —6. Average daily deficiency since January 1, —0.4. Precipitation: 5.36; greatest in 24 hours, 2.03; date, 19th; average of this month for 38 years, 3.78. Excess, +1.58. Accumulated excess since January 1, +1.65. Greatest February precipitation, 7.81, in 1893; least, 0.82, in 1895. Snowfall, 13.7. Wind: Prevailing direction, N. W.; total movement, 11,035 miles; average hourly velocity, 15.9 miles; maximum velocity, 58 miles per hour. Weather: Clear days, 11; partly cloudy, 10; cloudy, 8; on which 0.01 inch, or more, of precipitation occurred, 11. Sleet, 19th; fog (dense), 13th, 14th. Mean temperature of the winter, 32.63; normal, 31.73. Mean precipitation of the winter, 4.370; normal, 3.647. Total snowfall, 28.7.

THE CURRENT SUPPLEMENT.

The great increase in the world's annual consumption of iron ore has led to careful inventories of the world's supply of iron ore, its rate of depletion, and further supplies. The subject is well considered in the current SUPPLEMENT, No. 1680, by Prof. Charles Kenneth Leith. It appears almost incredible that in the twentieth century, and after the diligent labor of Le Verrier, the theory of the motions of Mercury should remain an unsolved problem. The three centuries of study which have been lavished upon the problem are splendidly reviewed by the well-known French astronomer Abbé Moreux. The famous German archæologist Friedrich Delitsch in an article entitled "Babylon," gives the progress and results of the German explorations. Dr. Bechhold has approached the problem of definitely proving the existence of chemical molecules in a new way. He was guided by the idea that it must be possible to separate dissolved substances from their solvents by sufficiently fine filters. His method is described in an article entitled "Ultra-Filtration." Wolf La Baume writes on the behavior of plants toward aluminium. The "Fight Against Extermination" is the title of an article on some birds which are rapidly becoming extinct. The article is admirably illustrated. The subject of war balloons is admirably handled by Auguste E. Gaudron, a well-known French aeronaut. The oxy-acetylene welding process affords to engineers the most practical and valuable method yet discovered of dealing simply and economically with a great variety of metallurgical operations. Mr. Cecil Lightfoot discusses the subject in an able article. Mr. W. Duddell contributes a splendid paper on the arc and the spark in radiotelegraphy. Dr. Theodor Koller shows how molasses is used in the arts. Aeronauts will doubtless read with interest a splendid article excellently illustrated on some new flying machines.

A NEW PLANET.

A cablegram received at Harvard Observatory from Kiel states that a planet has been discovered by Melotte at Greenwich, positions of which are as follows:

January 27—5306 G. M. T. R. A. 8h. 46m. 7.2s. Dec. +18 deg. 03m. 34s.

February 28—4782 G. M. T. R. A. 8h. 31m. 32s. Dec. +19 deg. 16m. 13s.

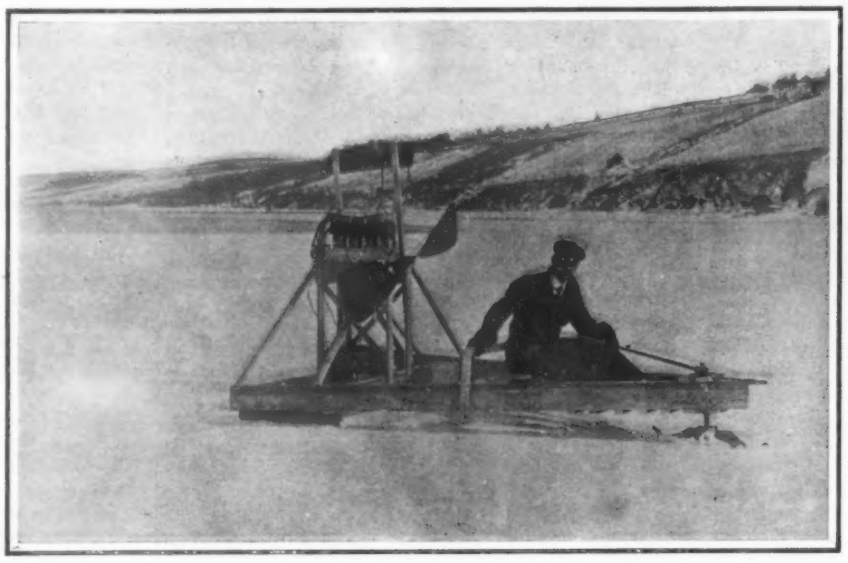
The object has been observed on eight days, and is possibly a satellite. It is visible in a large telescope.

It is estimated that 150,000,000 tons of coal are used annually by the railways of the United States, out of which but 7,500,000 tons are used in drawing the trains, while 142,500,000 tons go up the smokestacks.

A MOTOR ICE BOAT.

The motor ice boat shown in our illustration was constructed by Mr. G. H. Curtiss of the Aerial Experiment Association for the purpose of testing an air propeller under conditions similar to those found on a fast-moving aeroplane. The engine used was a 4-cylinder, air-cooled, Curtiss light-weight motor of 15 horsepower and 100 pounds weight. The propeller was 5 feet in diameter with a 4-foot pitch. As can be seen from the photograph, it was mounted upon the engine crankshaft. With the engine making 1,000 R. P. M. and the boat held stationary, the propeller developed a thrust of 60 pounds, while in all probability, when the boat is traveling at its full speed of over 30 miles an hour, the thrust of the screw reaches 75 or 80 pounds, since under these conditions the revolutions increase to 1,350 per minute.

So successful has this method of testing an air propeller been found, that it is expected to test a new aeroplane soon in a similar manner by fitting it with runners and driving it at high speed over the frozen surface of the lake.



THE MOTOR ICE BOAT—THE LATEST TESTING APPARATUS FOR ASCERTAINING THE EFFICIENCY OF AN AERIAL PROPELLER.

THE FASTEST SHIP IN THE AMERICAN NAVY.

The "Chester," the first of the three scout cruisers which were authorized in 1904, has recently completed a series of very successful official trials; and, by steaming for four hours at an average speed of 26.52 knots, she has established her position as the fastest ship in the American navy. This performance is particularly creditable to her builders, the Bath Iron Works, Bath, Me., and it constitutes another triumph for the Parsons marine turbine, with which this ship is driven. The results are far in excess of the contract, which called for only 24 knots an hour. The "Chester" is the first of an entirely new type, to which the Navy Department has given the title of "scout cruisers." She is designed purely for scouting, and her lines were drawn, and her general proportions outlined, with a view to producing a ship of large coal capacity and capable of maintaining a high average speed in rough weather. As will be seen from our engraving of this vessel taken on her trial trip, she has a lofty forecastle deck, with a freeboard on normal displacement of about 30 feet. The freeboard amidship is about 20 feet, and 21 feet aft.

The general particulars are as follows: Length between perpendiculars, 420 feet; length over all, 423 feet; breadth on load waterline, 47 feet 1 inch; mean draft, 16 feet 9 inches; displacement at that draft, 3,750 tons, which was the displacement on trial. The maximum bunker capacity is 1,250 tons, and with this amount of coal and full ammunition supplies her displacement is 4,687 tons. She was designed to give 24 knots an hour with 16,000 horse-power. She carries 2 inches of nickel steel at the waterline, and some measure of protection is afforded by a watertight deck. The armament consists of two 5-inch rapid-fire guns, one forward and one aft, and six 3-inch rapid-fire guns; these guns being mounted mainly for protection against torpedo-boat attack. She carries two of the new 21-inch turbine-driven torpedo tubes, submerged below the waterline.

Special interest attaches to the three ships of this class because of the differences in their motive power. The "Chester," built at the Bath Iron Works, is driven by Parsons marine turbines; the "Salem," built by the Fore River Shipbuilding Company, Quincy, Mass., is propelled by marine turbines of the Curtis type; and the "Birmingham," also built at Fore River, is propelled by twin-screw vertical, triple-expansion engines. This will afford an opportunity for an absolutely fair comparative test of three types of engines. The Curtis and the Parsons turbines will be able to settle the question of superiority under exactly identical conditions, and the well-tried, multiple-expansion, reciprocating engine will have an opportunity to surpass both types in the speed achieved and in the economy of coal consumption. As matters now stand, the Parsons turbine has certainly set the figures of speed and economy at a very high mark.

DETAILS OF OFFICIAL TRIALS OF THE SCOUT CRUISER "CHESTER."

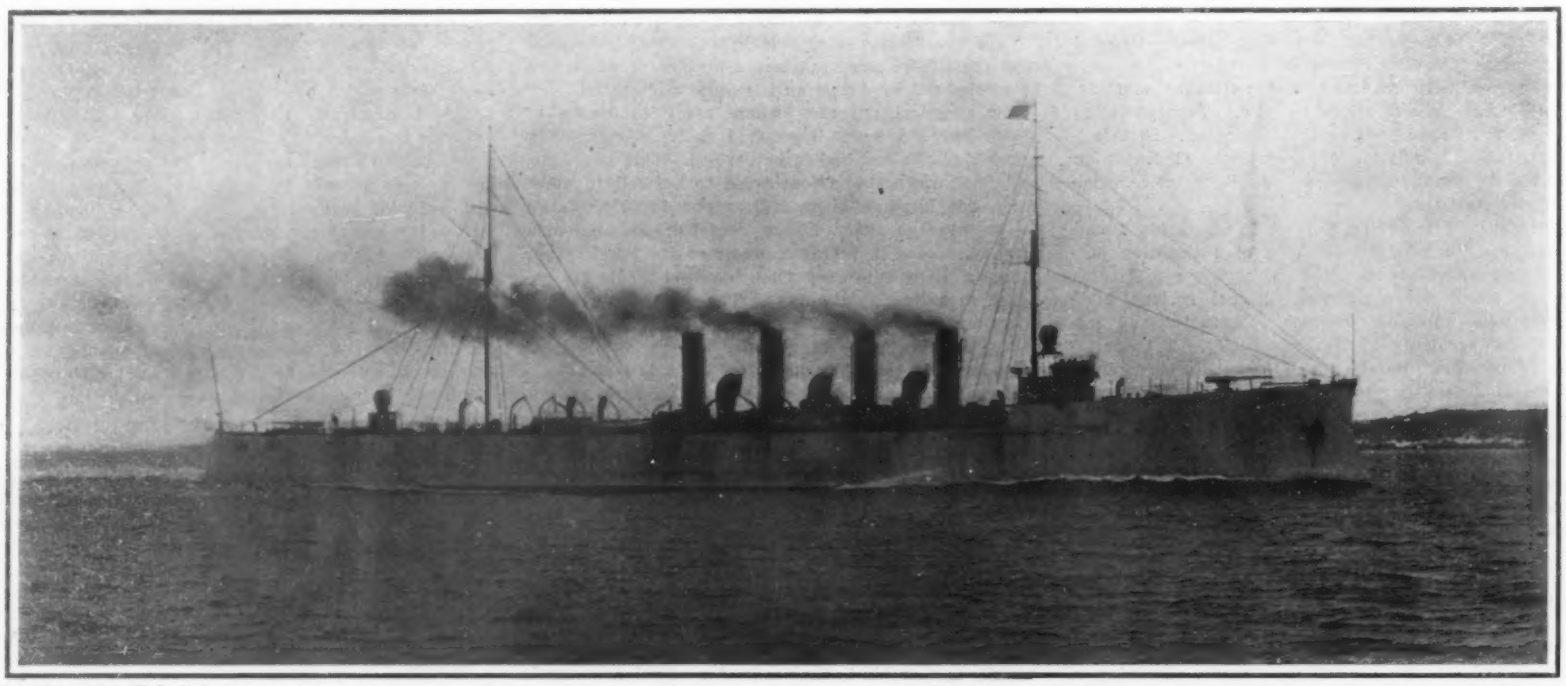
	Contract.	Trial.
4-hour trial.		
Average speed per hour for 4 hours	24 knots	26.52 knots
Maximum speed for 15 minutes		26.6 knots
Distance covered in 4 hours	96 knots	106.08 knots
Steam pressure allowed at steam chest	250 pounds	240 pounds
Air pressure allowed	5 pounds	3 pounds
24-hour trial at 12 knots.		
Speed	12 knots	12.2 knots
Coal, approximate		43 tons
24-hour trial at 22½ knots.		
Speed average for 24 hours	22½ knots	22.78 knots
Speed maximum for 1 hour		22.9 knots
Distance covered in 24 hours	540 knots	546.72 knots
Coal consumption in knots	1.75 knots per ton	2.84 knots per ton

The details of coal consumption, air and steam pressure, etc., as given in the accompanying data of the four-hour trial at maximum speed, the twenty-four-hour trial at 12 knots, and the twenty-four-hour trial at 22½ knots, show how excellent was the performance of this ship. The excess of over 2½ knots speed above that required by contract is even better than it looks; for while 250 pounds steam pressure was allowed at the steam chest, only 240 pounds was used; and the air pressure was only 3 inches instead of the contract pressure of 5 inches. Furthermore, on the twenty-four-hour trial at 22½ knots an hour, the speed was 22.78 knots an hour; and whereas the contract required that at this speed the vessel should cover 1.75 knots per ton of coal burned, she actually covered 2.84 knots per ton. Another significant fact is that during the 24-hour trial the evaporating and distilling plant of the vessel was run at its normal capacity, it being necessary to run the plant continuously at a rate which would evaporate and distill 10,000 gallons of fresh water in twenty-four hours. The steam heat, the ventilation system including all electric blowers, the forced-draft blowers, the sanitary system, the steam to steam tables and for stewards' use, the steering engine and ice machine, were all in continuous operation during the twenty-four hours. Also the electric light plant was run continuously to furnish light for all parts of the ship. Hence the covering of 2.84 knots per ton of coal burned was under the conditions an extremely creditable performance.

The Crane in the Foundry—A Chance for Inventors.

Inventive thought might advantageously be turned toward the crane in the foundry. The crane service is vital, but it is installed with little consideration for economy. A crane can only serve one floor at a time, while others have to wait, and the heaviest castings may be blocked while the crane is toying with a hundredweight. A bridge traveling crane is a useful machine, but there is no practical way of letting two pass each other. Those who are familiar with practical foundry work will readily recognize where crane service might be improved.

To Destroy Field Mice.—Barium pills, made from 800 parts of barley-meal dough and 200 parts of precipitated carbonate of barium. 250 parts of the poison intimately mixed with 1,000 parts of barley meal, made into a paste with a little water. Made into pills about the size of a hazel nut and pushed in a half soft, not hardened condition, as deep as possible into the mouse holes.



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Length, 423 feet. **Beam,** 47 feet 1 inch. **Normal draft,** 16 feet 9 inches. **Normal displacement,** 3,750 tons. **Full load displacement,** 4,687 tons. **Speed,** 26.52 knots. **Coal,** 1,250 tons. **Armor,** 2 inches at waterline. **Armament:** Two 5-inch; six 3-inch. **Torpedo tubes,** two 21-inch. **Date,** 1907.

NEW 26 5-KNOT SCOUT CRUISER "CHESTER"—FASTEST CRUISER IN UNITED STATES NAVY.

POETRY AND SPEECH SUBJECTS OF SCIENTIFIC INQUIRY.

BY HERBERT T. WADE.

That the physicist and the psychologist should be able to enter the realm of literature and study poetry by minute measurement and methods of exact science at first thought might occasion considerable surprise. Yet that is precisely what has happened in one phase of a recent investigation in experimental phonetics. This subject naturally is one of considerable breadth, as the study of human speech involves a thorough knowledge of the physiology of the vocal organs, of theoretical and practical acoustics, and also of psychology, in addition to a complete understanding of the language forms themselves. Therefore it is not so strange that the scope of such an investigation should be extended to include a consideration of the basis and nature of poetry. Such indeed has been the case with some researches of Prof. E. W. Scripture, which in 1903 received the support of the Carnegie Institution of Washington, and which since have been prosecuted with great vigor both in this country and Germany.

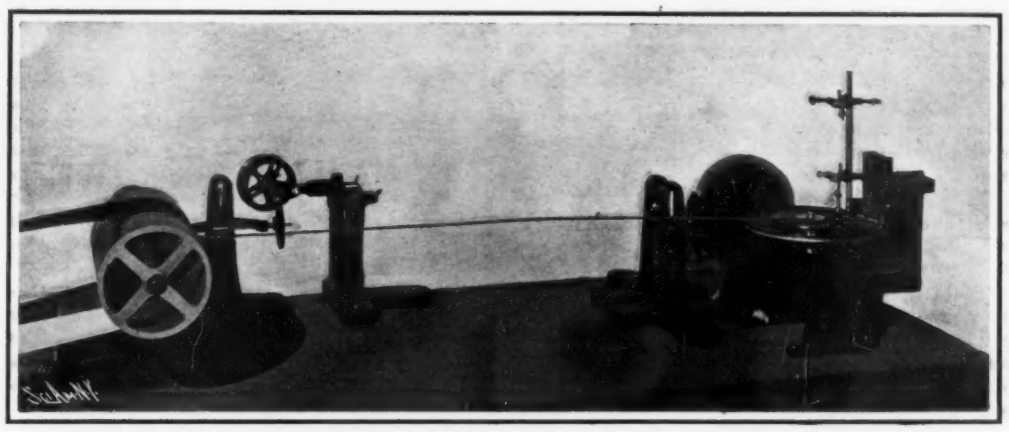
Prof. Scripture started with an attempt to use natural science and scientific methods in the study of verse, bearing in mind the fundamental consideration that poetry must be studied, not in its printed form, but as it flows from the mouth of the poet or is spoken by the public. Such a study could be carried on by the ear; and while this has produced valuable results, and is still of great assistance, yet from the scientific standpoint it is vastly inferior to a method where the spoken words are registered automatically for future study and reference. Notwithstanding their many defects, the gramophone and phonograph in Prof. Scripture's hands have proved the most satisfactory means for the study of human speech, since their records can always be tested by direct reproduction, and also since they can be employed to furnish magnified speech curves for both qualitative and quantitative study. In addition to adapting the gramophone and phonograph to his investigation, Prof. Scripture was able to devise an ingenious arrangement of apparatus for reproducing and magnifying the records in the form of curves, which afforded data for the minute examination of the original speech. At first these curves did not supply any immediate explanation of the laws of verse, but rather seemed to indicate new and additional problems in the field of voice vibrations, yet after painstaking study material was secured from which Prof. Scripture has derived some most interesting and important conclusions.

The instruments employed in this investigation were of the usual type, but with carefully-selected diaphragms, which as well as the rest of the apparatus were adjusted with greatest care. For tracing the records in magnified form from the disk, the apparatus shown in the illustrations was employed. Explained simply, it consists of a point attached to the short arm of a lever, whose long arm carries a tracing point in contact with a band of smoked paper passing over a drum. As the point at the short arm follows the curve on the record disk made by the vibration of the diaphragm of the receiver, the long arm traces a corresponding but magnified curve, so increased in size that all the various sinuosities are most apparent. The mechanical details are sufficiently indicated by the illustrations, and it is not essential here to go further into the construction of the instrument than to say that it is driven by an electric motor, and that every requisite refinement in construction and operation is observed. The moderate enlargement of the speech curve of a four minutes' conversation requires a band of smoked paper a quarter of a mile in length, and this with the fact that the apparatus must run sufficiently slowly to enable a clear record to be made for every wave, indicates the care with which it must be adjusted and operated. The long arm of the lever is made of a light straw, and its vibration is very carefully tested before the experiments are commenced.

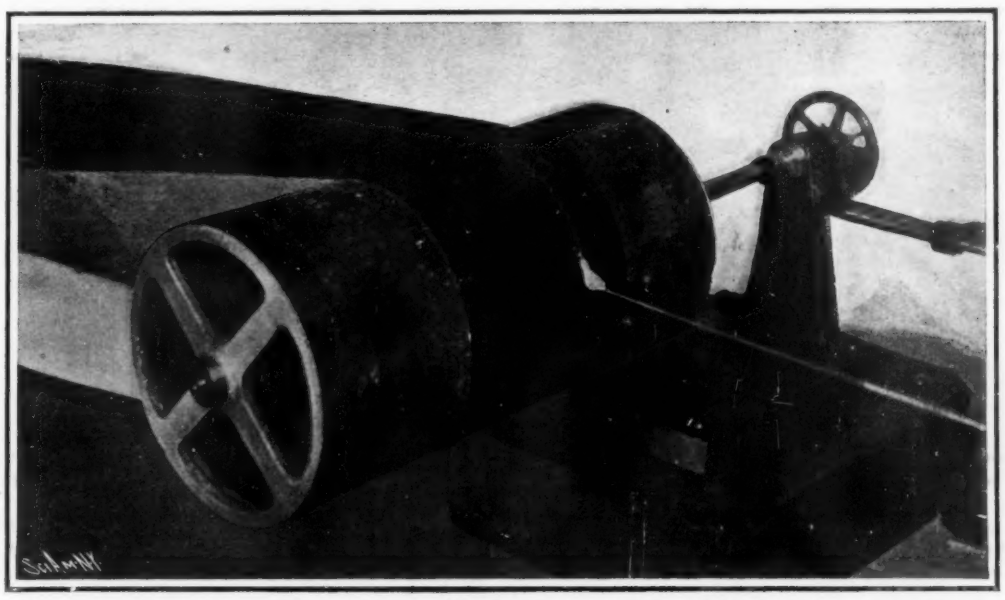
The record to be studied then is a curve of a wave motion where the amplitude, or vertical movement above the horizontal axis or position of rest, and the wave length, or distance of a mountain and valley, as well as the general curve as a whole, supply us with the desired data.

Music curves are comparatively simple in comparison with the vibration of the human voice, where variations depending on each passing emotion, the condition of health, individual peculiarities, changes in dialect, every difference both in vowels and consonants, are noted distinctly, and can be fully explained only by much study and an infinite amount of computation. One of the curves shown herewith is a portion of a speech on "Forefathers' Day" by the Hon. Chauncey M. Depew, and indicates the difference between the vowel and consonant sound. Thus line 94 shows the weak vibration for the *w* sound in "without," followed by the stronger ones for *i* and the weakening for the *th* sound, which extends into line 95. The words here represented are "Without regard to race or creed I can." For the curve of a vowel sound the vibrations fall into a series of wave groups, as is clearly indicated in line 96. Each group represents the results of one puff or vibration from the glottis after acting on the vocal cavities, and the length of the group corresponds to the period of the puff or pitch of the voice, the shorter groups of the curve representing of course the higher tones. Inspection of the voice curves shows that, in speaking, the voice changes its pitch at every instant, and that while neighboring curve groups show a resemblance to each other, no two are exactly alike, though the changes are gradual. It also shows that the cavity tones, i.e., those formed in the vocal cavities — the chest, throat, and nose—are never constant, and Prof. Scripture believes that recognition of this fact must effect changes in the prevailing view of sounds found in works on phonetics and dictionaries, as these notions are based on typography rather than on actual sounds. Accordingly, he suggests that speech curves such as those here illustrated should be prepared for the various languages and dialects, and should be studied carefully by all students of phonetics. In speech it is important to recognize that there is a flow of sound that cannot be represented by any spelling, as there are no definite boundaries between neighboring sounds, and there are absolutely no independent sounds.

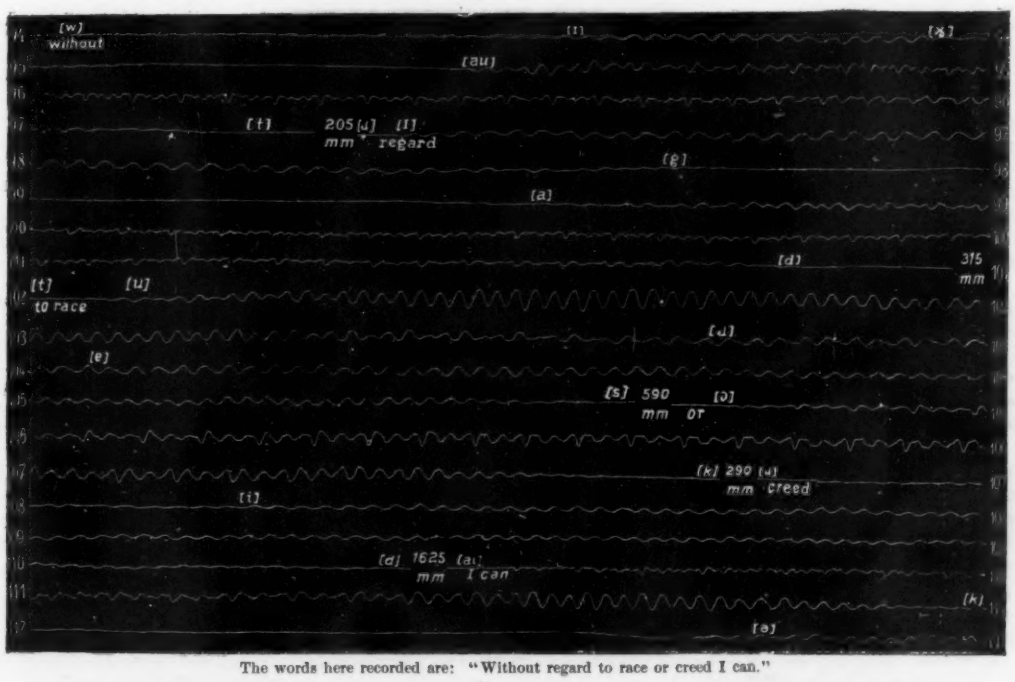
The qualitative analysis of speech curves can be carried to almost any length, and supplies much that is interesting and instructive, and a large number of these curves have been prepared by Prof. Scripture. One of these records shows short-section waves from the vowels of a record made by the late Joseph Jefferson while reciting "Rip Van Winkle's Toast." This plate gives a characteristic record of the American



The Record Disk and the Lever Which Traces a Record on the Band of Paper.



The Band of Smoked Paper Traveling Over the Drum. The Lever Point is Recording One of Signor Caruso's Notes.



The words here recorded are: "Without regard to race or creed I can."

Record of Portion of a Speech Made by Hon. Chauncey M. Depew on Forefathers' Day.

THE ANALYSIS OF SPEECH CURVES.

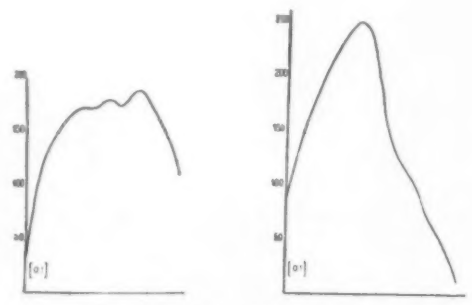
vowel, where the pitch changes constantly, the sound depending on the respiratory pressure, glottal tension, and vowel configuration, which vary constantly. Such a record would show marked differences from one obtained from a cockney English speaker, where the variations in the vowels would be much more marked. The languages and dialects of Europe, or even the differences in the speech of the most cultured people of different centers, have given many interesting curves. It is from these experiments that Prof. Scripture concludes that many if not most of the shorter vowels and some of the longer ones are incorrectly indicated in the dictionaries, and also he believes that there are more vowel sounds than are recognized by phoneticians.

While the qualitative work thus outlined forms an important part of this study of phonetics, yet there is a most elaborate mathematical discussion of the curves, involving their accurate measurement with a finely-divided scale or micrometer microscope. This enables one to study in the first place the duration and amplitude of the sounds, and also the melody, or the fluctuation of the pitch of the tone from the glottal lips. From each explosion, puff, or vibration from the glottis we get a group of vibrations forming a wave or wave group, and it is with these we deal in our study of melody. Now in music, melody proceeds by steps, and the tone is constant in pitch for the time of each note, as indicated in the accompanying figure, where the notes and their melody plots are indicated. In speech, however, there are other considerations, and to lay off such a curve we take time along the horizontal axis and denote the frequency or pitch by the vertical distances. Thus in the melody plot shown in the diagram representing first the interjection *Oh* pronounced sorrowfully, there is an example of rising melody or vowel convexity. Again we have the same interjection but spoken admiringly, the curve showing considerable variation, as do others shown under different conditions. This melody has been found to be different when a speaker changes from conversation to recitation, and it seems from experiments made in Germany that cultured people will change to the same melody in reading poetry, even though they have never heard the pieces before. This enables the poet to count on a certain responsiveness on the part of his audience if they are made up of cultured people, who will instinctively fall into the natural melody. The uncultured, however, may have a different standard of melody, and Prof. Scripture suggests that this factor may be of influence in distinguishing a local from a national poet.

In the mathematical consideration of the speech curves, a careful test of harmonic analysis was undertaken, and an attempt was made to represent these speech curves as a harmonic series of simple sine waves. By elaborate study it was found by Prof. Scripture that this was not correct, as the curves were not simple sinusoids, but were acted on by factors of friction, which vary with the friction of the sound waves in the vocal cavities. It is to this friction in the vocal cavities and the associative formation of the vowel at the glottis that Prof. Scripture calls especial attention, as the theory that the vowels are formed by membrane-like vibration in the larynx seems to him utterly false. By the opening and closing of the vocal lips of the larynx there are emitted a series of puffs of air, just as occurs in a siren. Furthermore, the action of the cavities has been universally assumed to be the same as that of metallic resonators, and this also Prof. Scripture considers false. These vocal cavities are adjusted to certain tones for each vowel, which are produced after a succession of puffs from the larynx strikes them.

With the wealth of data in the form of gramophone records, curves, melody plots, and the results of computations thus at his disposal, it is but natural that Prof. Scripture should reach some understanding and positive conclusions as to the nature of verse. He opposes all theories that verse depends upon syllables, feet such as the dactyl, iambus, and trochee, and other arbitrary divisions, on the ground that they are not supported by experimental phonetics, and claims that verse is a flow of emotion to which the laws of psychology must be applied. Here again we must bear in mind that it is poetry as spoken that is being considered, not the printed words and letters. Although we may arbitrarily divide the syllables of the words as written into feet arranged according to some theory involving various forms of arrangement of syllables as regards value and quantity, yet we must provide elaborate explanations for various exceptions, and establish the most artificial devices to assist us in carrying out the plan. To schemes of versification neither the reader nor the poet gives heed; the latter aims simply to give expression to the rhythmical impulses that he feels. In short, he demands merely that there should be a series of regularly-recurring groups of beats in substantial harmony with his flow of thought.

This idea is illustrated best in studying the stately



"Oh" Sorrowfully—and Admiringly.

The Variation in the Same Vowel Spoken Differently.

forms of English verse as distinguished from the more simple, which often is merely singsong or musical, where the "strong" or "weak" syllables of prosody can be applied. In the grander verse the rhythmical expressive impulses indicate the division of ideas as grouped into stanza, line, or phrase. There can be no arbitrary division by syllables either on the part of the speaker or hearer, asserts Prof. Scripture, and the thought must flow in a rhythmical manner free from artificial construction or limitations. This is proved by reference to the curves, where it is impossible to cut off any feet or to mark distinctly the beginning or end of any group of vibrations. With vocal music, on the other hand, it is possible to recognize often the beginning and end of a note, as the singer is trained to cut it off sharply and abruptly by bringing together with a snap, as it were, the lips of the glottis. Consequently, where we have the speech curve showing a gradual change from one group of waves to another, the record of a singer often may show an abrupt transition.

The relation of melody to verse, to which reference has already been made, is one of the most interesting phases of the investigation. The theory was originally put forward by Prof. Sievers, of Leipsic, that each piece of verse had a specific melody or variation of inflection, which was inherent in the particular poem. This Prof. Scripture has substantiated in the course of important experiments performed by him while in Germany. It involved the selection of a simple German poem, which was recited for him by a number of different speakers, representing different localities and dialects, where there was a marked difference in inflection as well as in other speech characteristics. Obtaining records from these speakers, the melody curves were plotted, and it was found that while individual peculiarities of inflection and pronunciation were of course apparent, yet there was substantial agreement as regards the melody, the rising and falling inflection demanded by the poem being observed by all. This melody is essential to true verse, as without the change of inflection there would be an absolute monotone, which would be at variance with our conception of poetry.

To reach these and other conclusions has involved a vast amount of labor and elaborate computation on Dr. Scripture's part, but the scope of his work is constantly broadening. Recently he has taken up the study of the voice in singing, and some interesting developments may be looked for in a subject noted for the great diversity of views held by vocal instructors, physicists interested in acoustics, and physiologists and throat specialists.

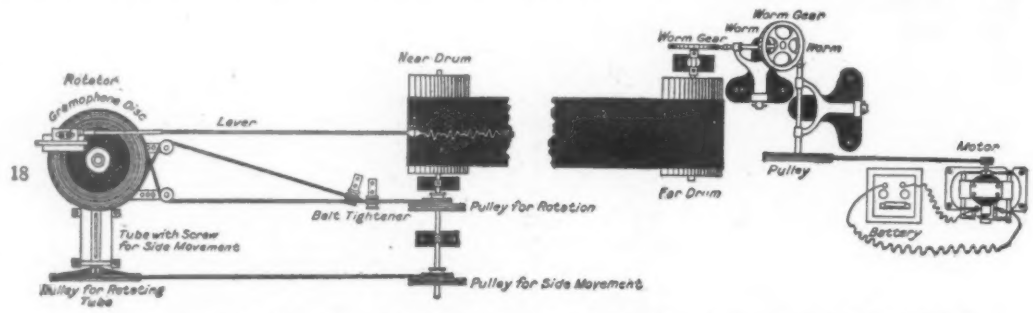
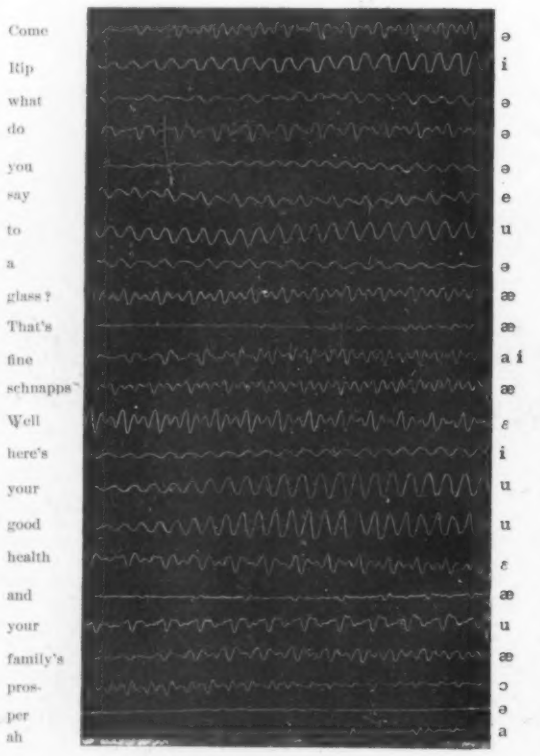


Diagram Showing Construction of the Instrument for Registering the Curves of Speech Sounds.



Rip Van Winkle's Toast Spoken by Joseph Jefferson.

THE ANALYSIS OF SPEECH SOUNDS.

A Transparent Filler for Wood Which Prevents Oil from Striking Through.

In the polishing processes used heretofore, the pores of the wood are closed by rubbing in some pore-filling powder or "filler" or by polishing with pumice stone. The materials used for this purpose are without exception of mineral origin, used in connection with an agglutinative. These substances after being mixed are used in the form of paste, liquid, or powder. This method has the disadvantage that the filling of the pores, while desirable for one purpose, is itself undesirable. The mineral substances penetrate not only the coarse but also the finer pores of the wood, and as they are opaque and have a different color from the wood and the polished coat which follows, the color and the peculiar individual grain pattern of the wood suffer. Most of the materials used also have the disadvantage that while they are very greedy of oil they do not hold the oil permanently, with the result that while the oil in polishing is absorbed by the pores, it comes out of them later, under the influence of changes of temperature.

A new German process has for its object to fill the pores of the wood with a transparent material which will prevent oil from striking through. The wood is polished in the usual manner with linseed oil or other polishing oil, after which all superfluous oil is rubbed off with soft paper saturated with alcohol. On the polishing surface thus prepared a coat of shellac (which has been purified and clarified by filtration) is then applied in the form of the finest spray possible by means of an atomizer and the articles are polished with a solution of celluloid in alcohol by means of polishing balls. The well-known peculiar motion of polishing drives the shellac spray into the pores of the wood; but at the same time the liquid pressed out from the polishing balls is well absorbed by the pores. The celluloid solution forced into the pores dissolves the shellac particles, and as shellac in a dissolved form is a most excellent agglutinative, the celluloid is attached firmly to the walls of the pores. As the shellac used for this purpose is filtered and purified, its solution in the pores is perfectly transparent. The celluloid solution increases the elasticity of the filler. This shellac filler is said to unite better than any other material with the shellac polishing material used for further carrying out the polishing process.

A writer in a contemporary states that he examined the envelope of a balloon which burst at the International Exhibition at Milan in 1906. A number of spots were visible on the envelope, and at these places the material could be easily torn, whereas at other parts it showed great resistance to tearing. These spots were found to have been caused by phosphoric and arsenic acids, produced by oxidation from arseniureted and phosphureted hydrogen contained in the hydrogen gas. The presence of these impurities is due to impure materials in the preparation of the hydrogen, and the author recommends that the preparation of the gas for filling balloons should be under strict chemical control.

Correspondence.

A Curious Traveling Nest.

To the Editor of the SCIENTIFIC AMERICAN:

Your very interesting article on "Nests and Nurseries of Insects" in the last SCIENTIFIC AMERICAN reminds me of a curious traveling nest that I saw last summer, which may interest your readers. It was also a remarkable example of protective imitation.

The creature when I first saw him was crawling rapidly along a dusty road; but the instant I disturbed him all signs of life ceased, and I picked up what seemed at first glance to be a head of wheat, or large grass. On closer examination it turned out to be an artificial head. There were no grains in it, but little bits of straw and chaff ingeniously arranged around a central tube, all pointing in one direction, and simulating very closely the husks and short beard of some kinds of wheat. Where the stem of the wheat-head should be, the mouth of the tube was drawn tightly shut, so that no one at first glance would suspect that a living creature was therein.

When left alone long enough, however, the little door opened, and revealed the mouth of a well-made silken tube, which formed the core for the artificial head of wheat. Soon a worm's head protruded, followed by the thorax, with several pairs of legs, and worm, nest, and all began to hurry away. When I touched him again, however, he instantly disappeared in his hole, and, literally, "pulled the hole in after him," leaving only the head of wheat.

Unfortunately, this time the worm outwitted me, so that I failed to get his photograph. He tired me out waiting for him to reappear, and then, when I left him for a few minutes, he made off so successfully that I never saw him again. On only one other occasion nave I seen this kind of creature, and never heard of it elsewhere than in this region.

HENRY H. RIGGS.

Harpoot, Turkey, December 31, 1907.

Balloon Varnish.

To the Editor of the SCIENTIFIC AMERICAN:

The matter of balloon varnish seems to be giving a lot of trouble. It always has, more or less, as commercial varnish manufacturers do not make balloon varnishes, and none of the ordinary varnishes serve well for balloons. What is wanted is an elastic, nonadhesive, and enduring varnish that will not heat or spontaneously decompose. Pure boiled linseed oil comes the nearest to these requirements. The difficulty is in getting it pure to begin with, and keeping it unmixed with oxides or dryers when boiled. Any such admixtures lay the seeds of destruction, for oxidizing, if once started, is kept up continuously till the mass is rusted or rotted finally, and the fabric made brittle or sticky, and soon useless.

Balloon varnish is not a matter of formula or recipe, but a process or system of preparation, and thus requires experience, judgment, and to some extent courage, as it is more or less dangerous to produce good linseed oil varnish cooked at a high temperature. I have known one large varnish factory to be entirely destroyed in attempting to make balloon varnish, and I have seen over a hundred conflagrations of more or less magnitude result from boiling oil to make balloon varnish. I only make balloon varnish once a year, in considerable quantities, requiring weeks with special apparatus, on a manufacturing scale, and I aim to keep a year's supply on hand, and use the oldest and best. My varnishing is done by patent machinery permitting the use of pure linseed oil varnish too thick to spread by hand brushes. One thousand yards of surface requires about one hour's work, all superficial varnish being removed by the machines, after which the fabric is dried spontaneously in the hot sun without oxidizing dryers. This process is repeated several times till seven to nine films are superimposed with increased thickness appreciable by a micrometer caliper after the first coat is applied. The microscopic pores in each film do not coincide, or are plugged up, resulting in a practically hydrogen-proof fabric, of light weight and thickness, which can be folded or rolled repeatedly without fracture of the films at ordinary temperatures, and which never decomposes or sticks or becomes rotten when packed.

This fabric in 100-yard rolls, of various grades, I keep for immediate use by myself. There is only a limited demand for this or my varnish besides, the prevailing impression being that any one can make varnish from a formula, or the secret recipe, just as any one can tan hides and make shoes if told how.

I have tried very many preparations and found them mostly disgusting for continued usefulness. The best of these include good boiled linseed oil as a basis, thinned with best spirits of turpentine or stove gasoline for use with hand brushes. Dryers to be used are chiefly litharge or "japan" and chrome yellow. "Bird lime" and rubber are sometimes mixed in small quantities with linseed oil varnish, and are of doubtful value.

Raw or half-boiled linseed oil will never make other than a sticky coat, necessitating frequent dusting with talc, chalk, or other similar preparations, and will inevitably ruin any balloon coated with it.

While almost any varnish in repeated layers will serve to hold gas temporarily, or for immediate use on a balloon, such vessels are short-lived, heavier than desirable, and not satisfactory for airships or vessels required to hold hydrogen for a long time.

Balloon Farm, Frankfort, N. Y. CARL E. MYERS.

Identification of Neptune.

To the Editor of the SCIENTIFIC AMERICAN:

Fearing that many young amateur astronomers who read the February astronomical article might obtain an exaggerated impression of the difficulty of identifying Neptune for themselves, I will try to tell how I succeeded in obtaining my first sight of that faint member. The method is very well known among many amateurs for locating the inferior planets in daytime.

Granting that the observer possesses a small telescope (two-inch aperture is sufficient) mounted upon some kind of a stand, I will explain my method by taking the actual conditions for the middle of March. The amateur should provide himself with the ordinary star atlas, without which he can hope to do very little, also something that will give him the positions of the planets. The American Ephemeris and Nautical Almanac for the current year will supply all the data needed. The Ephemeris will also give him the position of any lucid star whose declination is within the desired limits (the list of stars occulted by the moon is just what we want). Thus:

Neptune's R. A.	6h.	52m.	14s.
d Geminorum R. A.	6	46	2
			6m. 12s.

From this we see that *d* Geminorum precedes Neptune by 6m. 12s.

Declination of Neptune	+22 deg.	05m.
Declination of *d* Geminorum	+21	52
		13m.

From this we see that Neptune is 13m. north of *d* Geminorum or 36 Geminorum, as it is called sometimes.

So we set the telescope with the center of the field of view 13m. north of *d* Geminorum. After waiting 6m. 12s. Neptune will occupy the center of the field. Now carefully chart all the stars seen in the field, and repeat the observation in a few days, and Neptune will betray its identity by its motion. (Neptune will be one of the brightest stars in the field.) This method will be found very useful in locating any other faint object such as comets, nebulæ, and star clusters.

WILFRID GRIFFIN.

Pittsfield, Mass., February 24, 1908.

The Recent Criticism of Our Navy.

To the Editor of the SCIENTIFIC AMERICAN:

I would like to say a few words in regard to Mr. Van Brimmer's letter of recent date. I think he will find that he has stirred up a hornet's nest, and it seems impossible to me for anyone that read your article to come to the conclusion that he did. He points out the five great charges against the navy, which are as follows:

(1) Faulty distribution of armor. (2) Low freeboard as a distinguishing feature of our battleships. (3) Open turret communication with the magazine. (4) Archaic system of selecting men to command our fleets. (5) Lack of sufficient battle practice. Here I will quote a few lines from Mr. Van Brimmer's letter, which runs as follows: "Now in regard to the last four of these charges, what have you to say? Only this: That they are faults—serious faults—faults that are found to a far greater extent in our navy than in the British navy or in the French navy." I can not find any place in your article where you admit any of these faults but No. 3—open turret communication with magazine; and this one you state is being remedied in our latest ships. Your article proved that charges Nos. 1 and 2 are entirely false or greatly exaggerated. I can not find any place in your article where you speak of the selection of men to command our fleets, neither of the lack of sufficient battle practice, but I believe the American seaman gets as much training as the average seaman of foreign navies. Mr. Van Brimmer speaks of your reviling Mr. Reuterdahl, but I find no place in your article where you revile him in the least. One would be led to think from Mr. Van Brimmer's letter that the American navy was the only one that had any "red tape" connected with it, that the foreign navies were perfect in every detail. If the French ships are armored so well, why was it so many of the Russian ships, which are of the French type, were sunk in the Russian-Japanese war? I wonder if Mr. Van Brimmer would kick any worse if the United States should throw away a few million dollars on a worthless invention. If our battleships were never any good, why was it they whipped the fleets of a much older nation in the Spanish-American war? Though I think speed is essential in battleships, it is not for me to condemn the designers.

What greater proof is needed of the fact that our navy is equal to that of any foreign navy than the letter from Berlin which you publish?

JOHNNIE LYNN.

Eldora, Iowa, February 13, 1908.

Competition for Apparatus or Device for the Humane Slaughtering of Animals for Food Purposes.

Painfully conscious of the cruelties inflicted upon animals by the present methods of slaughtering and desirous of preventing, as far as possible, the suffering of animals at the moment of giving up their lives for the benefit of mankind, the American Society for the Prevention of Cruelty to Animals, through its Board of Managers, offers a reward of five hundred dollars ($500.00) for the device or apparatus, not now in use, which will best accomplish the humane destruction of animals used for food purposes; to be competed for under the following conditions, which constitute an agreement between the society and each competitor who submits a design under its provisions.

The competition is open to all without restriction.

The society reserves the right to reject any or all proposals.

The award will be made by the Board of Managers of the society.

The design may be submitted by means either of drawings, or a model, or both, together with such description as may be necessary to a proper understanding of the apparatus. Proposed details of construction may be shown by a supplementary drawing of the section; or by a typewritten description.

Each sheet of drawings and each model shall be unsigned, but shall bear a device, cipher or emblem for identification; and the same device, cipher or emblem shall be placed on a sealed envelope containing the competitor's name and address. This will not be opened until the award has been made.

Drawings and models, with the accompanying envelopes, must be securely packed or wrapped and delivered at the office of the American Society for the Prevention of Cruelty to Animals, 50 Madison Avenue, New York, before 6 o'clock P. M. on Monday, June 1, 1908.

Competitors are requested to call or send for their drawings and models within one week after the award has been announced.

The apparatus or device must meet the following requirements:

First: It shall, with the least possible suffering, accomplish the desired object of stunning or killing the animal.

Second: Its use shall not occasion any deterioration to the flesh, nor any serious loss in the value of the skin or other portions of the animal's body for commercial purposes.

Third: The difficulty, cost, or time required in its practical operation, under all conditions, shall not be so great as to preclude its general adoption.

Any inquiries regarding this competition should be addressed to Alfred Wagstaff, President the American Society for the Prevention of Cruelty to Animals, New York.

McAdamite.—A New Light Alloy.

A new aluminium alloy named McAdamite, after its inventor, William A. McAdam, has recently made its appearance. In addition to its low specific gravity (3.40), it is wonderfully strong. Careful tests show that it has a compression strength of 126,000 pounds per square inch and an elastic limit of 84,000 pounds. The cast alloy will stand a compression of nearly 45,000 pounds to the square inch. Among its other good qualities are its freedom from occluded gases, its homogeneous, close-grained structure, the ease with which it can be machined, its low melting point (977 deg. F.), its resistivity to acids, its toughness, and its elasticity. The best brasses and bronzes are decidedly inferior to this new alloy in point of strength, fusibility, and ductility. McAdamite should prove valuable in the construction of automobiles, motor boats, flying machines, and in industries where an easily cast, light, yet strong metal is required.

Introducing New Inventions in Foreign Countries.

Consul Albert Halstead, of Birmingham, invites the attention of American manufacturers of new inventions to the fact that while they may be satisfactory in the United States, they may not be satisfactory in the United Kingdom, until proved. He cites the case of an English agent who communicated with an American manufacturer of a novel device, informing him that he was ready to purchase six of these articles, for which he would pay in six months, to be placed in industrial centers to prove their worth, and that if the device proved as satisfactory as he thought it would, he would make every effort for its general introduction. The manufacturer would not agree to the terms, but in a year afterward, thus losing valuable time, he opened negotiations with the same agent.

A HOSPITAL FOR SMALL ANIMALS.

BY JACQUES BOYER.

In M. Lépinay, a leading veterinary surgeon of Paris, small animals have found a firm friend. Under his guidance a society has been formed for alleviating or painlessly terminating the sufferings of diseased or crippled animals. Dogs or cats suffering from some sickness or from the results of accidents or fights, and less common small animals, as well as birds, receive attention.

In the tiny hospital under Dr. Lépinay's control all the resources of modern medicine and surgery are provided for "our inferior brothers."

Cats are frequent patients, and often they are difficult ones to handle. A cat may fight viciously when operated upon, and it is often necessary to inclose the afflicted animal in a sort of "straitjacket" or leather sack, which envelops the animal except its head and the place to be operated upon.

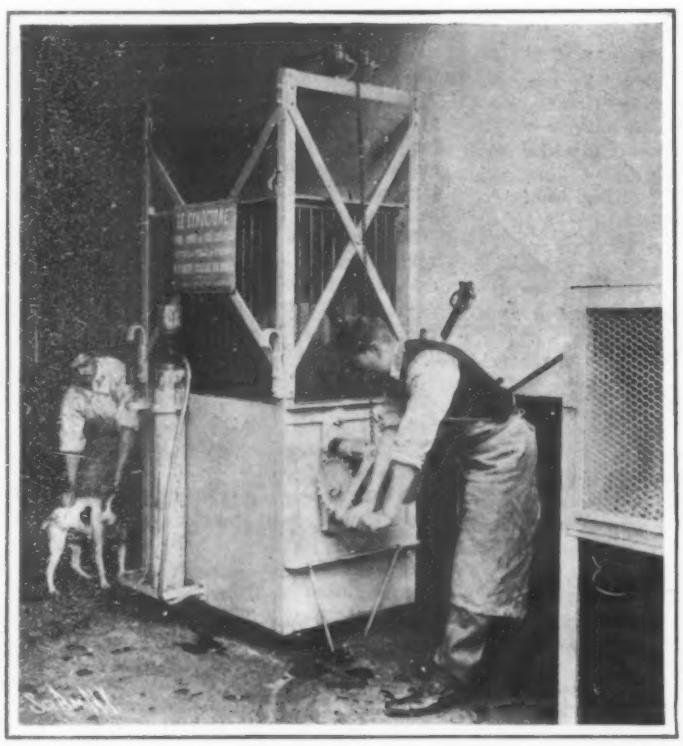
On the request or permission of owners, the pain of operation may be minimized by the use of anæsthetics. In one of the illustrations a dog which has had the tendons of its leg severed by a knife cut is having chloroform administered.

Binding a Slight Wound; Behind Are the Cages in Which the Patients Are Kept.

While the physician administers the anæsthetic in a metal cup held firmly to the nose of the dog, one of his assistants holds the jaws, while a third holds the hind limbs. After the operation the dog is cared for in one of the kennels of the hospital until its recovery is complete.

M. Lépinay uses massage when necessary. The apparatus, a pneumatic vibrator, is shown in operation on a pet monkey suffering from atrophy of the muscles as a result of a fracture.

Many patients come to the hospital suffering from incurable disease, and in such cases a painless death is the most merciful prescription. Carbonic acid is administered to them in a "cynoctone," a machine designed by M. Darthuy, being an adaptation of the one of Richardson. The animal is placed in a grille, which then descends into a sheet-iron chamber or tank which can be hermetically sealed. As soon as all the openings are closed, carbonic acid is passed into the chamber from the cylinder. In a few minutes the animal is dead, without having experienced any of the suffering which is sometimes caused when poison is administered with the food.



The Lethal Chamber; the Cage Containing the Animal is Lowered Into the Tank, Which Seals Hermetically. Carbonic Acid is Then Administered.

Vibratory Massage for Atrophied Muscles.

Administering Chloroform to a Dog Before Operating Upon It.

A HOSPITAL FOR SMALL ANIMALS.

Instinct or Reason?

Prof. Bose has described, in Die Umschau, a case of apparent exercise of judgment by a caterpillar. A larva of *Bombyx cossus*, the willow borer, was imprisoned in a match box, from which it quickly escaped by gnawing a hole. When caught and replaced in the same box, however, it made no further attempt to escape but prepared to spin its cocoon in the match box, which happened to be the most available site in the vicinity. As a measure of security the match box was then inclosed in a larger paper box, the cover of which was perforated with small holes for ventilation. On the following morning a large hole was found in the outer box, but the larva was pursuing its occupation of spinning in the match box. It occurred to Prof. Bose that the larva had made the hole in the outer box as a way of escape for the butterfly into which it was to be transformed. To test this theory both boxes were inclosed in a third paper box. In this also the larva made a hole and then returned to its work of cocoon making in the match box, where it completed its pupation.

This instance of a larva providing exits for the future butterfly, the purely suctorial mouth of which is unfitted for boring holes, leads Prof. Nestler to point out, in a later issue of Die Umschau, that an action analogous to this exceptional one is performed regularly by the larva of a tropical butterfly.

The so-called "jumping beans" are the carpels of a Mexican species of Euphorbia, or spurge, which are inhabited by larvæ of *Carpocapsa saltitans*. These seed vessels, which have approximately the size and shape of small beans, move in a spasmodic and apparently spontaneous and mysterious manner, though their hard outer skin appears to be quite intact. The movements of the bean, which are especially lively when it is placed on the hand or otherwise warmed, are caused by corresponding movements of the imprisoned insect, which passes its entire larval and pupal existence within the completely closed pod, as the investigations of Nestler and Buchanan have proved.

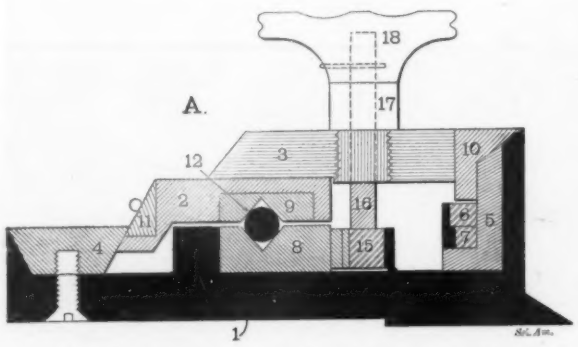
The mouth of the larva is furnished with an apparatus which enables it to operate almost in the manner of a fine scroll saw. With this apparatus it makes a circular cut through the hard wall of the "bean." The excised disk remains in place and no trace of the operation appears on the outside, but a gentle push on the part of the butterfly suffices to open this ingeniously contrived door and allow the insect to escape. The interior of the pod is then found to be lined with a fine and dense web but otherwise empty, the seeds having been devoured by the larva.

It has been proposed to use electro-magnets for lifting and handling large panes of glass, states the Engineer. This is accomplished by placing a piece of sheet iron under the glass, and applying one or more electro-magnets on the upper face of the glass. The electro-magnets attract the sheet iron, and thereby hold the glass suspended while moving.

THE OURDAN ENGRAVING MACHINE.

BY C. H. CLAUDY.

It would seem an unchallengeable statement, that accuracy is the first essential of a chart for mariners' use. Yet any mariner would rather have his chart inaccurate, in some particular, than to have an error in the compass card of the chart. The compass card of the chart is more important to the sailor than the correctly set semaphore to the engineer, more vital than wireless warnings to the liner, plowing through a heavy sea, more important than the storm warning to any coastwise vessel. For the mariner with a chart on which is an incorrect compass card is misdirected to safety, and is led to almost certain shipwreck. An error of a hundredth part of an inch in cutting a compass card may spell the difference between a channel and a rock. Obviously, therefore, the compass card jumps to the front, and holds a place of first importance. And the cutting of these cards in the copper plate of the chart becomes not only a matter of skilled labor, but also a responsibility, notwithstanding that the work is inspected and tested, tested and inspected, many times, before the chart is finally printed.



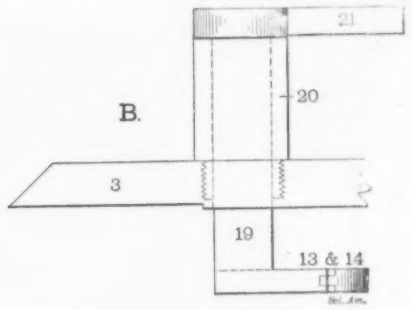
Cross-Section of the Various Metal Rings Constituting the Machine.

These cards were formerly cut by hand. The operator would first "lay out" the card, that is, draw or trace the card upon the copper plate, and afterward go over it slowly and patiently by hand with the graving tools to produce the circles and their divisions.

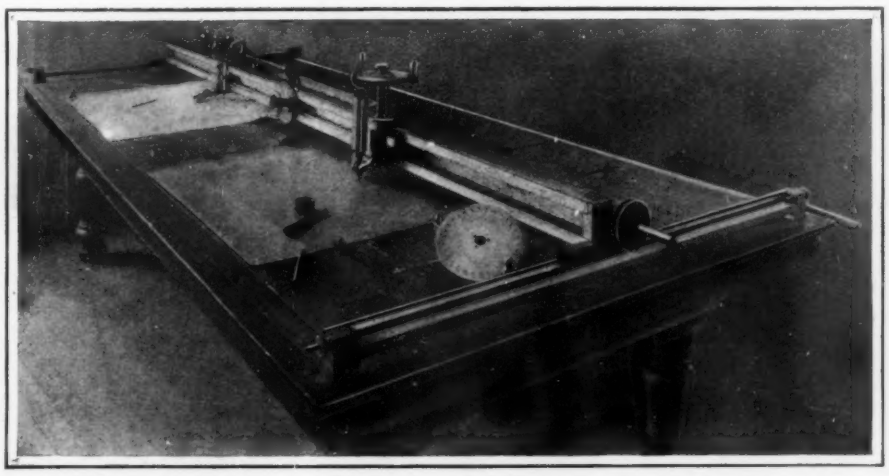
Now the work is done by machinery, the delicate, accurate little apparatus employed being the Ourdan engraving machine, the invention of Vincent Le Comte Ourdan, for many years in the Hydrographic Office at Washington but now an inventor and manufacturer of engraving devices and doing a general chart-engraving business. The market for such machines is of course limited, but the price is high, and the machines are practically indispensable. It formerly took a man three days to lay out and cut one compass card. Now the same man can cut three and even more compass cards in one day, and do it, too, with even greater accuracy than before. The machine is simple in conception, but somewhat complicated in construction. Reference to the accompanying photographs and diagrams will, however, make its construction and operation clear.

It will be seen from the accompanying illustrations that from the central supporting pillar *X* depend two arms, *A A*, holding a bar on which is the shot can for weighting the graver so that it will bite the plate beneath. One end of this bar, *P*, in the photograph is a plunger which impinges on the turret of wheels *T*. This turret contains disks with indentations at the edges, in which the plunger *P* strikes on the back stroke of the carriage, *C*, moved manually by means of the handle *H*. The stroke first lowers the graver to the plate, then revolves the turret one notch, and finally moves the graver, the forward movement being limited by the stroke of the plunger *P* against the indented turret disk. It will be noticed that there are four disks. The plunger can be set opposite any of the four by hand, according to the kind of circle to be cut, whether magnetic or degree points, and wherever the long and short marks of the degrees are desired to come.

The diagram herewith shows that the machine is of annular construction, being built of no less than eleven rings. One is the base, holding all the rest. On this base rests a steel ring, 8, having on its outer periphery a toothed rack and on its upper surface a ball race. Ring 2, with a steel inserted ball race, rests by means of bicycle balls upon this, forming the permanent revolving carrier, and is retained in position by the keep ring 4. Ring 5 is a carrier ring holding two steel rings, 6 and 7, 6 having 360 notches at equal spaces around its interior surface, and 7, immediately below, 120 such notches. Ring 3 is the removable tool carrier; there are two of these, one containing the card-engraving mechanism, and one containing the letter and figure engraving mechanism. The diagram shows the milled wheel 18, which connects to a pin 16 passing through a collar 17, and which, by means of the toothed wheel 15, engages the toothed rack on the outer surface of ring 8. Turning this milled wheel 18 thus revolves the tool carrier at the will of the operator.



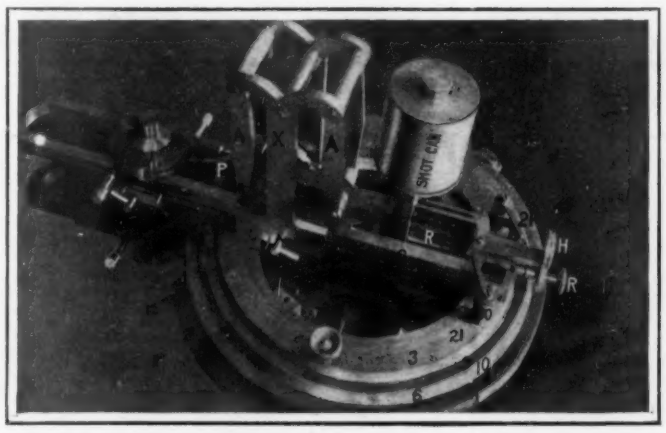
A Detail of the Ourdan Mechanism, Showing the Retaining Pawls.



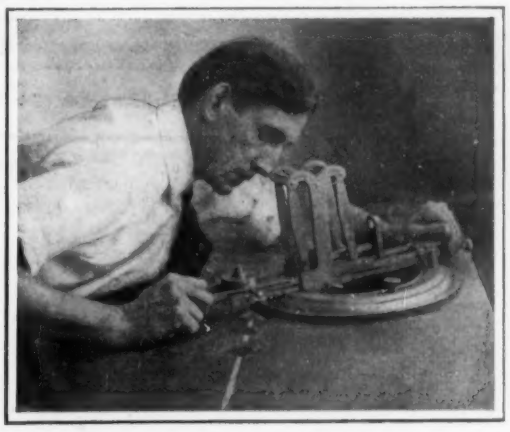
Adaptation of the Pantograph, a Device for Engraving Sounding Depths Upon Charts.

A pawl 21 engages with the front of carriage. In the return of the engraving stroke, the carriage engages this pawl, which extends down through the ring 3 and ends in another pawl that engages one of the notched steel rings 6 or 7. There are two such pawls and sleeves, one on either side of the carriage. One engages 6 and the other 7, and either can be used at will. One revolves the rings 3 and 2 (here mechanically one piece) one 1/360 of the circle, and the other one 1/120 of the circle, according to whether mariners' points or degree marks are being cut. A sufficiently heavy spring, not shown in the diagram, holds the rings stationary when not being revolved by means of the pawls.

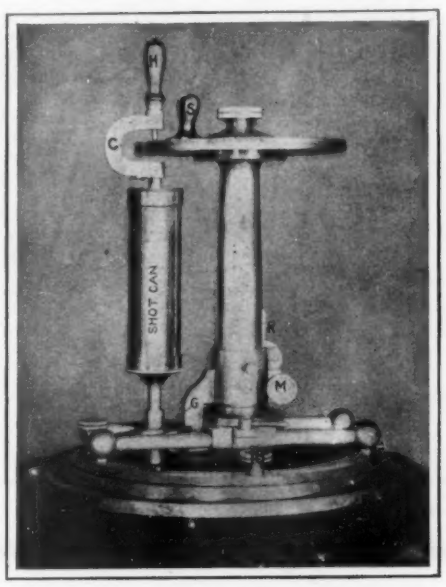
When the machine is to be used, the operator sets it over the plate where the card is to



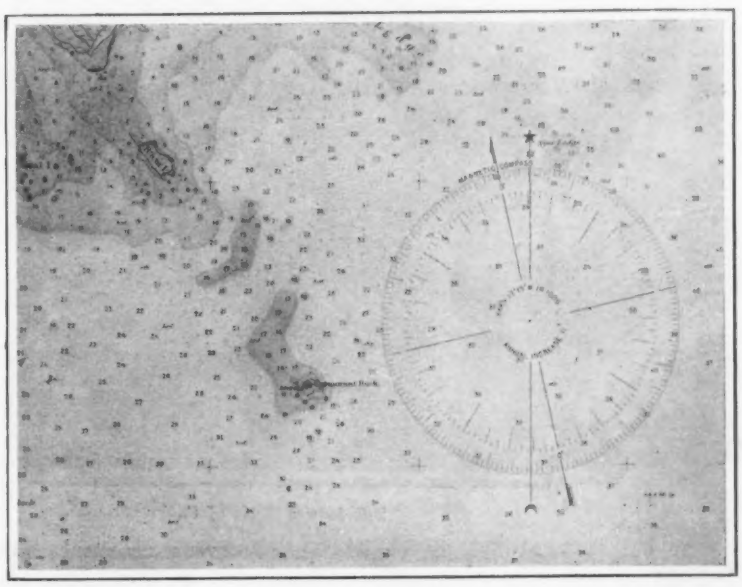
The Machine Set for Engraving the Compass Card.



The Ourdan Engraving Machine in Use.



The Machine Set for Cutting Letters and Figures on the Compass Cards of Charts.



A Finished Chart, Showing the Engraved Compass Card, Upon the Accurate Position of Which, the Accuracy of the Chart Depends.

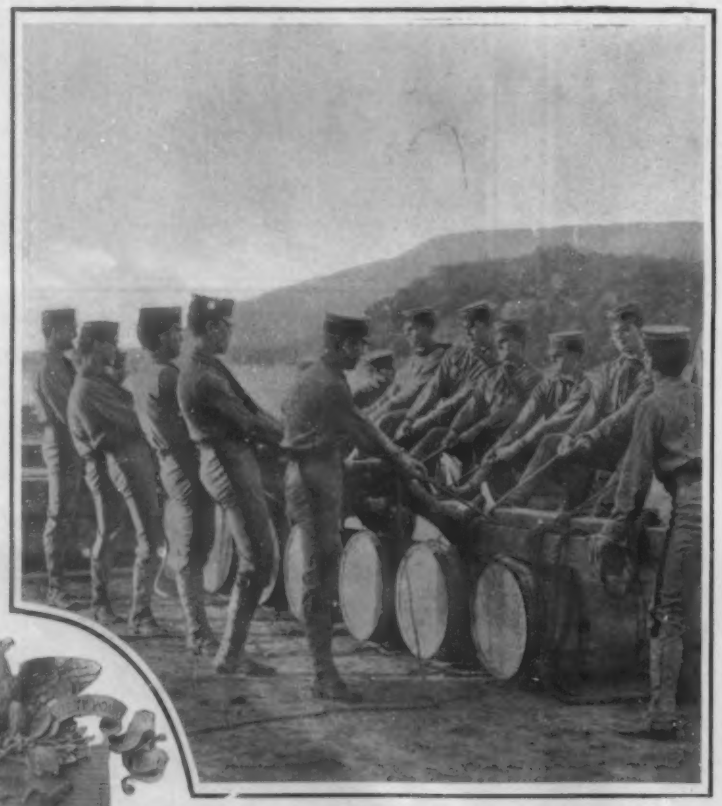
THE OURDAN ENGRAVING MACHINE.

12-inch Mortar Drill; Seacoast Battery.

Target Practice.

Automobiling—One of the Sports of the Cadets.

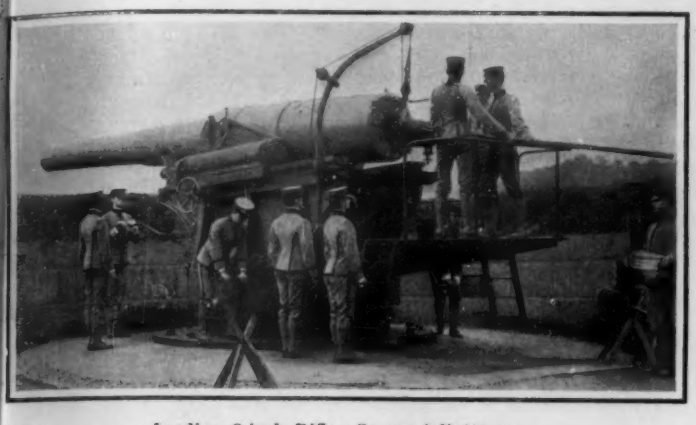
Prince Louis of Battenberg viewin



Building a Raft of Casks.

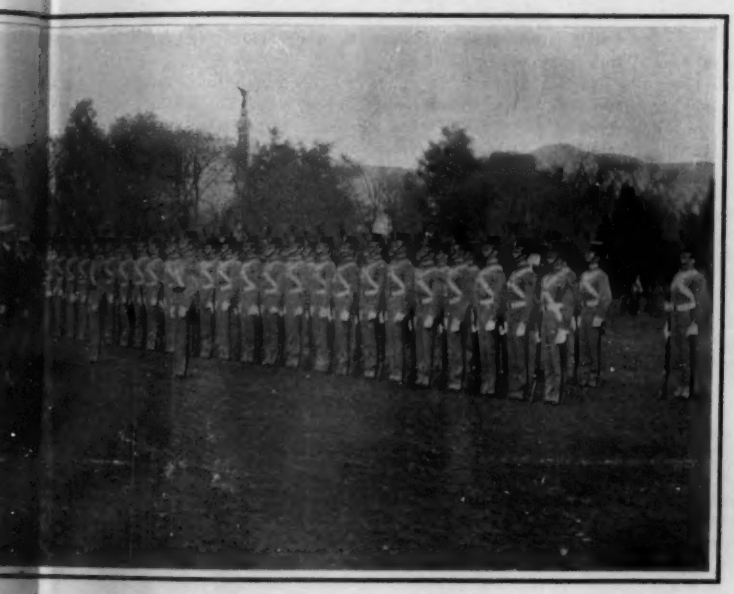
Parade of Squad of Ca

THE UNITED STATES MILITARY ACADEMY AT WEST POINT.

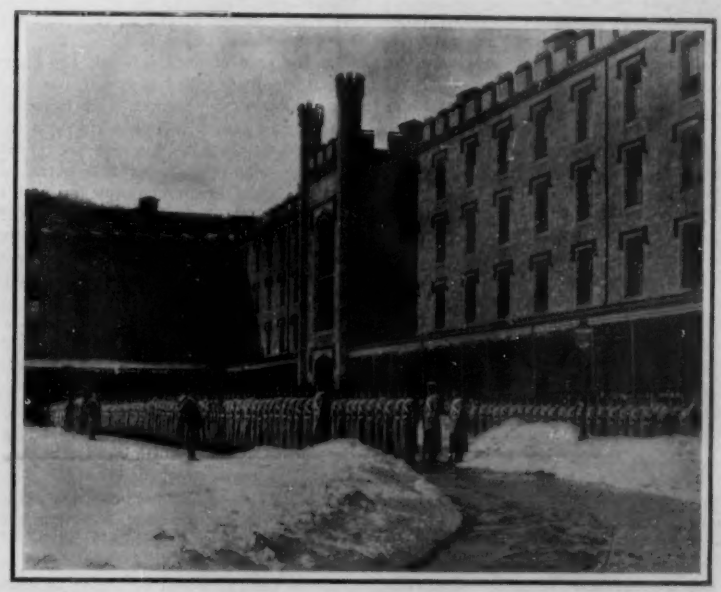


Loading 8-inch Rifle; Seacoast Battery.

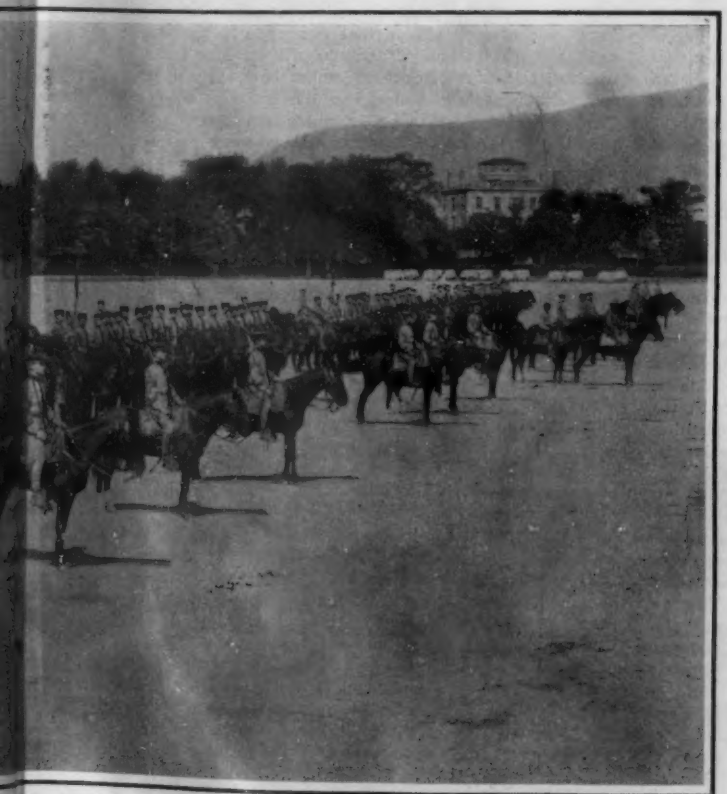
Target Practice at 600 Yards.



nbers viewing the Corps of Cadets.



Saturday Inspection in Barracks Area.



of Cavalry.

In the Ordnance Laboratory.

be cut and fastens it to the plate by pressing around the outer ring quantities of stiff black beeswax, which clings closely to the metal and the copper and holds the whole firmly in position. The strength of the wax about the entire circle is enormous, and ample to protect the machine from moving with the comparatively slight effort used to operate the graver.

The size of the compass card to be cut is determined by the setting of the screw *R*. A compass card can be cut nearly as large as the interior of the inner circle or as small as may be desired. As a matter of fact, there are seldom any other sizes used than four, ranging from about two inches in diameter to five inches, according to the size of the chart and the number of cards cut upon it. The depth of the graver cut is entirely proportional to the amount of weight upon it, which is altered at will by adjusting the weight of shot in the shot can.

It will at once be seen that if the machine itself is accurate in making its divisions and in meeting its first mark at the end of one revolution, the accuracy demanded of the operator is only in the setting. It will also be seen that, if this is so, the chances for error are enormously reduced. Instead of having to lay out by hand the hundreds of divisions of the compass, the operator has only to determine accurately a starting point, say the north and south line, and the machine does all the rest.

The engine is a beautiful example of machine work, and although so many lives and so much property depend upon its accuracy, it is hardly too large to enter a good-sized silk hat.

The cutting of the card finished, the little machine, by a change in its mechanism, goes right on and finishes the job, putting in the letters and the all but microscopic figures with mathematical accuracy and in the right place, and what is more—for neatness is dear to the heart of the chart maker—with the same curvature as have the circles. The engraving mechanism is removed from the permanent carrier 2, and its place is taken by a clever adaptation of the pantographic principle. Here the graver ends in a shot-weighted can, as before, but instead of being hung as a pendulum between supporting arms, it is supported in gimbals, *G*. The upper end of the graver arm ends in a crook *C*, and finally in a point which passes through the crook *C* to a plate bearing on its surface, in one case the necessary letters of the alphabet, and in another the digits. These characters are all intaglio and reversed. The pointer on the handle *H* being dropped into one of these depressed letters or figures, and the whole made to follow the course of the character by the hand of the operator, the graver below of course must execute the same figure, and the character is produced, cut in, reversed, in the copper. After a letter is cut, the graver is lifted from the plate, and the whole is revolved by means of the milled head 18 until the graver is over the position for the next letter, which is seen by a comparison of a pointer on the revolving ring 3, with letter and figure marks on the ring 10. The size of the letters and figures is governed by the height of the pivotal point in the gimbals *G*, the height being altered by raising or lowering the gimbals by means of the milled head *M* and the rack *R*. As the engraving mechanism is revolved from letter to letter, the words and phrases are written on a curve.

The letters and figures are brought successively under the pointer of the pantograph by revolving the upper plate, which is then clamped in position on the lower, stationary plate, by means of the split spring handle *S*, visible on the upper surface of the plate.

In the illustration of the compass card will be seen numbers of small figures. These have nothing to do with the compass card, being soundings of the water at the points where the figures are. These also are cut by a machine, the invention of the same man, where formerly they were cut by hand. The machine is a huge pantograph. The chart to be cut is fastened to one side of the large table which forms the body of the machine. The copper plate copy of the chart is fastened down opposite. On rollers running on tracks at each end of the table is a strong steel beam. Running on the beam, and operated by a screw, are two traveling standards, one of them holding an engraving mechanism like the last one described above, and the other bearing a glass plate with cross hairs. This little plate is adjusted so that the hairs come over some particular point on the chart, say the "neat" line. The copper plate is then moved until the same point on the plate is under the graver. This operation is repeated until the two, chart and plate, are accurately and entirely oriented with regard to each other and the pantograph. This having been done, the cross hairs on the glass plate are brought exactly over the figures representing a certain sounding on the chart. The pointer of the graver is then over exactly the same position on the plate. All that remains to be done is to lower the graver into contact, revolve the plate until the proper numbers are beneath the hand graver, and engrave the figures. The operator then works the screw, and so pulls or pushes the heavy steel beam, until the cross hairs cover the next sounding, when the graver is made to repeat the process. In this way the soundings are transferred from chart to plate in about one-half the time formerly required to do so by hand, first making a tracing and then cutting the figures by hand.

Paper stretches or shrinks. The chart therefore may not be of the same size at the time the soundings are cut as it was when the initial engraving of the plate was done. To compensate for this discrepancy, the locating point, the cross hairs in their carrier, have an independent motion of their own, both north and south and east and west. When a chart and plate are found not to agree in size, they are both divided into areas, each of which bears the same relation to the total size of plate or chart. After completing the soundings in any one area, the chart and plate are re-oriented—not by moving the chart, but by adjusting the locating point by means of its independent motions. This serves to distribute error due to shrinkage or stretching of paper over the entire area, and so minimizes it that it is inappreciable.

The wheel at the end of the beam is in the tight loop of a wire which is fastened at each end of the track. There is a similar wheel and wire loop at the other end. Revolving the shaft of the wheel thus moves the beam; there is thus absolutely no lost motion in the detail of the device as long as the wires are tight. Small screws at each end can be turned to keep the wires always taut.

In the case of each machine the engraving as done is not complete. The engraver has to go over every cut afterward and smooth it up by scraping, removing the burr of copper left as a ridge on each side by the graver. No machine has yet been found which will do this. But, in spite of this extra hand work, the two machines are much quicker and more accurate than the human engraver, and save the governments of this country (both in the Coast Survey and the Hydrographic Office) and of Germany and Japan an immense sum yearly, while greatly increasing the accuracy of the charts.

THE UNITED STATES MILITARY ACADEMY AT WEST POINT—WHERE THE AMERICAN OFFICER IS TRAINED.

BY OWEN MACDONALD.

Thousands of American boys cast longing wishes in the direction of West Point every time they hear it named. Almost every lad passes through a period when his one ambition is to be a soldier, and as he grows older he looks upon West Point as the stepping stone toward attaining this ambition. To most boys West Point seems like a rainbow, a glorious object, but one that it would be futile to chase. It takes a clever lad to get into West Point, and a cleverer still to stay there for the four years' course, so Congressmen nowadays have a very sensible practice of offering their appointments to the Military Academy for competition among the boys of their district. This makes it more likely that the lad who receives the appointment will pass the entrance examination, for this is stiff and thorough. But any boy who has made the most of his opportunities at school, and has stood high in his classes at a good high school, can, if he be physically sound, pass this examination, and the rest is merely a matter of honest hard work and backbone.

There is no use in disguising the fact that the work at West Point is hard. The discipline is Spartan, and the spirit that animates the whole corps of cadets will permit no infraction of the rules of conduct which have been laid down by the tradition of generations. It is true that every cadet must work without ceasing, with long hours to study and drill, and little time for play; but the work is intensely interesting, and much of it has all the qualities that make a sport exciting. Intelligent youths are glad to submit themselves to this rigid discipline, proud to feel that they have a share in maintaining the traditions that ruled the conduct of Grant and Lee, of Sherman and of "Stonewall" Jackson. They are old enough to know that this Spartan rule is necessary to make them good soldiers; that they can never know how to command unless they have learned first how to obey. The raw youth from the country, who arrives at West Point full of ambition and hope, learns instantly, and perhaps for the first time, that he is slouchy in his walk and ungainly and uncouth in his manner. He sees before him the well-set-up, erect, slender-waisted, clear-skinned, alert young men who have preceded him there by a year or two, and he feels that he too must look like this when the folks from home shall visit him. If he feels at first a certain rising of rebellion against the restraint and the rigid rules that he must obey, he soon gets over it, for the spirit of West Point enters his heart and his mind, stimulating his ambition and nerving him for effort.

The course of study is in many respects most attractive to a healthy-minded youth. Alternating with difficult mathematical problems are riding lessons; as a relief from the grind of theoretical tactics comes an hour of target practice with big guns; as an offset to the tedium of mechanical drawing there is sketching from nature; every summer the battalion goes into camp, and the cadets live under canvas, and while on practice marches the conditions are as nearly as possible like those of actual campaigning, excepting, of course, the wounds, the starvation, and the disease, that are inevitable to the latter.

On the practice marches the men are equipped in full campaign outfit, including intrenching tools. They carry over one shoulder the shelter tent and blanket roll, and on the other the knapsack and canteen; around the waist, the cartridge belt and knife bayonet. A certain number of men in each squad carry picks and spades.

During this short campaign the camps are made at irregular intervals at the end of the day's march. The length of the march depends entirely upon the nature of the maneuvers planned for the day's work. Each day has a tactical problem of attack and defense, which is carried on as in actual war; and at the end of the day, after camp is pitched and dinner and guard mount are over, a criticism of the operations of the day is given by the commanding officer. The work is very hard and tiresome, and if the weather is wet all hands are far from clean. A rubber blanket on the grass, and a little shelter tent, not much larger than a blanket, do not avail much against a rainy day, but all the same everyone is well and hearty, and takes hardships in a cheerful spirit as they come, as is befitting a soldier.

During summer encampment the regulations are modified in accordance with field service. The active work of camp drills takes the place of athletics, and relaxation is had in summer hops, and the society of the pretty girls who alight on West Point in flocks from June to September. There are few young men who would not consider it a hardship to have to handle rapid-fire guns and siege cannon, to build pontoon bridges, make rafts, and to drill long hours in the hot sun every day. But cadets look upon these as part of the education of a soldier, and while they involve hard, grueling work, they are the essentials of an officer's equipment for the responsibilities of command, and must be met in a cheerful spirit and as a matter of course.

As for the regular mess, it is, when not on the march, quite as good as any boy gets at home, and in many cases very much better. The food is abundant, of the best obtainable quality, well cooked, and served at the mess table as gentlemen are accustomed to having it served.

The Academy demands that every cadet shall be a gentleman, and that to say a man is a West Pointer must be in itself sufficient assurance that he conducts himself as such. If a boy arriving at West Point has not the bearing of a gentleman—which is often the case—the traditions and formative influences of the corps soon educate him in that regard, if he has the right spirit at bottom. If not, he will have to leave the institution. A blackguard cannot be transformed, and neither he, nor a liar, can live at West Point. Conduct unbecoming an officer and a gentleman is a violation of an article of war and is a court-martial offense.

The Military Academy is the most democratic institution on earth; money and social position count for nothing. A cadet may be the son of a President, a millionaire, or of a general who is the nation's hero, but he will receive treatment that differs in no way from that accorded to the son of a farmer or a laborer. Each will be judged exclusively on his own personal qualities, and his relations with his brother cadets will be pleasant, or disagreeable, according as these qualities are attractive or repulsive.

Through the four years which the cadet must spend at West Point the great incentive of becoming an officer in the American army is ever before him; the goal of a commission comes ever nearer with all the attractiveness of adventure in active service, the sight of foreign lands, the prospect of climbing the ladder of the service, and perhaps winning deathless fame as a victorious general.

From the moment a cadet takes the oath of allegiance he is a warrant officer in the army of the United States. He receives pay amounting, all told, to $609.50 per annum. Out of this he pays all his expenses of every sort—board, clothes, text-books and sundries—besides laying up an equipment fund at graduation of $450. And he earns his pay—every cent of it. He is giving exactly the work a soldier in the service gives in learning his duty as such plus three times as much more in study. It is a *quid pro quo*. He gives his life to the country, and renounces opportunity, and the pursuit of wealth, and at the same time works harder than a day laborer to learn his job as an officer.

Here is a specimen of what a cadet does every week day of the academic year, subject to such changes in detail as the season may impose, and with the exception that there is no drill after 4 P. M. on Wednesdays, and no duties after inspection under arms at 2 P. M.

on Saturdays, until retreat, which immediately precedes supper.

Reveille, 6 A. M.

Police call, 6:20 A. M. Rooms must be swept, bedding folded, and everything in perfect order.

Breakfast, 6:30 A. M. Thirty-five minutes allowed for breakfast, including going and returning.

Sick call, immediately after return from breakfast, 7:05.

Guard mounting, 7:15 A. M.

Call to quarters, 8 A. M. Academic period for study and recitation begins. Cadets confined to quarters when not attending recitations. Recitations and periods of study alternate until 1 o'clock.

Dinner, 1 P. M. Three-quarters of an hour allowed for this meal.

Call to quarters, 2 P. M. Second period for study and recitation extends until 4 P. M.

During both academic periods, from 8 A. M. to 4 P. M., there are also hours of attendance for riding and gymnastics.

Drill, 4 P. M. Squads form for various drills. Some attend light battery; others, standing gun, siege battery, seacoast battery, signal drill, target practice, pickets and advance guards, etc. Details for these drills change from day to day, and the drills themselves with the seasons.

Recall from drill, 5:20 P. M.

Parade, 5:30 P. M. to 6 P. M., depending on the season.

Supper, immediately after parade.

Call to quarters, 30 minutes after return of battalion from supper. Evening period of study extends from this time until tattoo.

Tattoo, 9:30 P. M. Preparation for bed.

Taps, 10 P. M. Lights out; inspection.

This schedule is an outline of the occupation of the cadets from September 1 until June 1, modified as to drills by the season. In the first week in June the "graduating exercises" take place, after which the battalion goes into camp. During this camp, which lasts almost three months, there are no academic studies, the work being purely military, and an entirely different schedule goes into effect. Reveille is at 5 A. M., and the day is spent in drills, practice marches, practical work in military engineering, target practice, scouting, sharpshooting, building and digging intrenchments and rifle pits, riding, and lessons in tactics in the open.

It will be noticed that during nine months of the year the cadet has no leisure except a short time after each meal; but during the summer he has two or three hours a day for amusement. However, at no time during his cadetship is he free from accountability for every moment of his time, sleeping or waking, and for every word and action. Every detail of his work and time is hedged about with orders and regulations from which there is no escape. He is taught to obey absolutely, unquestionably, in order that when he has been graduated he may know how to command. His bed and his clothes must be folded according to rule and placed just in their right places. His hair must be kept short. (Whistler, the famous artist, lost his cadetship because he would not have his hair cut, among other reasons.) His person and his clothes must be immaculate at all times; every going and coming must be registered; his quarters are subject to frequent and critical inspection; every penny he spends must be accounted for.

All of this Spartan strictness is imposed upon the cadets because the Military Academy undertakes to turn over to the American army as officers men whose morals, minds, and bodies it can guarantee, as well as men whose ability to perform their duties it has insured. The consequence is that when, at the end of his four years of hard work and unrelenting discipline, the proud cadet receives his commission and becomes an officer in the American army, all his energies are at a maximum of efficiency and his character is tempered like a Toledo blade.

Some New Flying Machine Prizes.

According to a cable dispatch, M. Michelin, the automobile-tire maker, has given a $20,000 trophy for an annual international aeroplane race. Besides the trophy, a cash prize of $3,000 goes to the winning aviator. The length of the first race is not given, but it is the idea of the donor to double the distance each year. M. Michelin, according to the dispatch, has also offered a cash prize of $20,000 to the first aviator to travel between Paris and Puy de Dome, some 250 miles distant, in an aeroplane before the year 1918. This prize is similar to that offered by the London Daily Mail, which is $50,000 for a flight of 180 miles from London to Manchester, England.

Among other recent prizes offered abroad is one of $2,500 for a flight of 10 minutes' duration this summer at the Munich exposition. It is also expected to hold an aeroplane race at Vichy, France, for cash prizes to the amount of $4,000.

A recent number of the Bulletin of the Bureau of Standards contains a long paper by Messrs. E. B. Rosa and N. E. Dorsey describing a new determination of the ratio of the electro-magnetic to the electrostatic unit of electricity. The value found by the authors, as a result of researches continued without interruption since November, 1904, is $v = 2.9963 \times 10^{10}$, taking the dielectric constant of air as unity. Referred to a vacuum, this becomes 2.9971×10^{10}. The authors believe this is correct to within 1 part in 10,000.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

DIAPER-HOLDER.—F. JONATA, New York, N. Y. The holder or container can be quickly opened, a diaper introduced or taken out, and as quickly and conveniently closed, adapting the diaper perfectly to the body of the child. The device is sanitary, can be worn with comfort, and no sharp objects are necessary in closing the garment or holding it closed.

HAT-HOLDER.—MINNIE E. CROUSE, Lawrence, Mass. The purpose of the invention is to provide a device especially adapted to hold a hat, bonnet, or other article of head-wear in position to be trimmed or lined, and to so construct the device that it can be quickly and conveniently attached for sustaining engagement with any size hat-crown, interiorly or exteriorly, and universally adjusted to bring the hat to any position required by the operator.

SHOE-LACE FASTENER.—G. H. NICHOLLS, Galveston, Tex. The object in this case is to provide a shoe-lace fastener for boots or shoes which shall be adapted to prevent displacement of the free end of the tongue as well as for securing the lace proper against the tendency to become unfastened when in wear.

Electrical Devices.

SUPPORT FOR ELECTRIC SERVICE WIRES AND CABLES.—E. H. GREENLEAF and T. A. DISSEL, Newburgh, N. Y. The object here is to provide a support, arranged to permit of quickly and securely fastening the supports in place on a span wire or the like, to allow of conveniently laying the service wires or twisted pairs in position, and to permit of running any one of the service wires or twisted pairs to a house from any point along the line.

WIRE-SUSPENDING DEVICE. — H. E. STEVENS, Macdonaldton, Pa. The object of the inventor is to provide a device easily applied, and more especially designed for use in mines and other places, for suspending and securely retaining in position the feeder or trolley wire of an electric haulage device or the like. It relates to devices such as shown and described in Letters Patent of the U. S., formerly granted to Mr. Stevens and Mr. Gellatly.

INSULATOR FOR HIGH-TENSION CONDUCTORS.—S. H. SUMMERSCALES, Winnipeg, Manitoba, Canada. More specifically, the purpose of the invention is to provide an arrangement for virtually increasing the length of the path of leakage from the conductor to the arm, and, further, to provide an arrangement for preventing, as far as possible, the leakage which is enhanced by the presence of water around the insulator in rainy weather.

INSULATOR FOR HIGH-TENSION CURRENTS.—L. STEINBERGER, New York, N. Y. This latest invention of Mr. Steinberger relates to insulators and admits of general use, but is of peculiar service upon transmission lines carrying currents of high potential, and is especially adapted to prevent arcing from the line to the support under conditions where such arcing would otherwise take place.

Of Interest to Farmers.

HAY-BALER.—R. E. ZIMMERMAN, Troy, Kan. The invention relates to that class of bale presses in connection with which wire reels are employed and mechanism for twisting the wire and binding the bale, and in the applicant's mechanism the essential operations of the parts are caused by the movement of the press follower acting on a movable door, the movements of the latter serving to properly shift the needles used in the binding mechanisms for the insertion of the wires in the twisting devices, after which a further movement of the door operates the twisting devices.

SPARK-ARRESTER. — D. MCIVOR, Humboldt, Minn. The design of the invention is to provide a spark arrester for use about a barn or pound yard. The arrester may be conveniently thrown back out of the way in kindling a fire, so that the draft may not be impeded and be afterward turned down again into operative position to restrain the sparks when the engine is at work.

PNEUMATIC GIN-FEEDER.—R. L. HOLLINGSWORTH, Decatur, Ga. The improvement refers to cotton cleaners and vacuum boxes and belt distributers, such as are used for removing dirt and sand from the cotton before the cotton is passed to a ginning machine. The object is to produce a machine having improved means for feeding cotton into the machine and for removing the dirt or sand.

CORN-HARVESTER.—J. HETTRICH, Grand Island, Neb. The point of novelty in this instance consists in providing the teeth or spokes of the wheels with hinged or pivoted terminals which are automatically operated as the wheel assumes a bent position while taking up corn from the ground and straightening out the same as soon as the load is ready to be deposited on the table or platform from which it is to be conveyed to the husking mechanism, for example.

BEET-PULLER.—L. PRUE and W. CHARLTON, Wabeno, Wis. In the general operation of this machine, as it is drawn forward the digging wheel lifts the beets from the ground and carries them upward toward the rear platform where they are released from the blades of the wheel and thrown upon the said platform.

WEED-CUTTER.—C. A. DESPAIN, G. A. KITT, and E. R. GORDON, Harrington, Wash. The invention refers to agricultural implements, and especially to weed cutters. The object is to produce an implement of this class of simple construction, which will operate efficiently to cut away or remove weeds, roots, and similar obstructions near the ground level.

CANE-CUTTER.—E. M. HIBBLER, Lyon, Miss. The construction in this case is simple and enables the ready adjustment of the parts and also permits the removal of the handle or the blade and the substitution of new ones, and also provides, apart from the connecting bolts, a device made in four parts, any one of which may be replaced whenever necessary because of breakage or otherwise.

Of General Interest.

COIN-RECEPTACLE.—E. W. ROBERTS, New York, N. Y. The object here is to provide a receptacle formed from a single blank by folding it into box form and locking it by integral locking flaps, to form a slit for the introduction of the coins, and to prevent removal of coins deposited in the box. It is designed for use of children as a savings bank, or for mite societies, Sunday-schools, etc.

PYROGRAPHIC TOOL.—J. P. MÜLLER, New Rochelle, N. Y. This thermocauter is provided with a handle fitted on the tool to insure the insulation thereof against the heat of the tool and thus protect the operator's hand, at the same time allowing the operating point to project the desired distance beyond the forward end of the handle, for convenient manipulation of the tool.

INKING-PAD.—D. T. O'SULLIVAN, West Orange, N. J. The inventor's purpose is to produce a pad which is adapted to be used with a small stamp, such as a dating stamp, but which can be also used for larger stamps; the general purpose being to protect the pad from dust or dirt and prevent evaporation of the ink, and further to construct the pad so that it will operate as a holder for the stamp.

MANUFACTURE OF CELLULAR BOARDS. —S. M. LANGSTON, Camden, N. J. The invention relates to certain improvements in the manufacture of cellular board or double-faced corrugated paper, and relates more particularly to the method and apparatus for the applying of the second facing sheet to single-faced corrugated paper and pasting parts together under a resilient but uniform pressure and while heat is being applied thereto.

SAFETY-RAZOR AND STROPPING DEVICE.—S. B. BATTEY, New York, N. Y. The object of the invention is to produce a device which can be readily manipulated to strop the blade of a safety razor without injuring the edge thereof. It is substantially automatic in operation in respect to the mechanism which holds the blade and reverses its position on the strop with each reciprocation of the blade.

COLLAPSIBLE LADDER.—W. J. BLUNDELL, New York, N. Y. The invention refers to certain improvements in means whereby the ladder may be folded to occupy the minimum space to facilitate storage or transportation, all of the parts remaining connected while in their folded position. One object is to provide a ladder and platform connected thereto and adapted to be automatically folded with the ladder.

MOLD.—W. J. MILLER, Coffeyville, Kan. The invention is an improvement in molds for glass and other articles, being especially designed for use on glass molds. In operation, when the mold is closed the yoke is moved to or nearly to or past the dead center of the mold, thus locking the mold sections securely together.

NEEDLE.—F. B. FOSTER, Santa Barbara, Cal. The inventor accomplishes the object of this improvement by forming the head of the needle with an aperture which enters the blunt end substantially centrally, and emerges a short distance therefrom at one side. At the point of emergence of the aperture an intersecting groove is provided, which is of sufficient depth to contain the strand or ligature with which the needle is threaded.

BOTTLE.—W. HARRISON, Day Dawn, Murchison, Western Australia, Australia. Mr. Harrison provides a bottle which cannot be refilled after being opened and emptied, without the refilling thereof being clearly apparent. This is accomplished through the releasing of a device detachably connected to the stopper, said device dropping to the bottom of the bottle as the stopper is removed.

KNOCKDOWN PLANT-BOX.—N. HIGHT, Wolfboro, N. H. The body portion of the box is in sections separable from each other and from the bottom, means being provided for holding the parts closely assembled while the plants are growing in the box, which locking means can be cast off to provide for seperation of parts and exposure of earth in which the roots are contained, enabling the plants to be removed and transplanted with their mother earth intact.

AIR-SHIP.—E. F. LEEDS, Mount Carmel, Ill. The ship is constructed with a screw or auger which is driven by suitable means, as an electric motor or turbine engine, and operates preferably as the sole means for lifting and driving the ship in its flight. A car is suspended from one end of the screw, from which the relative direction and inclination of the screw may be controlled by a rudder having a universal connection at the rear end of the ship.

PIPE.—F. P. NOURSE, Lewiston, Idaho. The invention provides for the collection of saliva and nicotin as it passes to and from the bowl, and the easy removal of the same in cleansing the pipe when desired; it also provides for the cutting of the charred tobacco and other collected matter from the bottom of the bowl, whereby it will fall out with the ashes, etc.

PHONOGRAPH-HORN.—V. H. RAPER, New York, N. Y. One purpose here is to provide a collapsible phonograph horn or megaphone, wherein the sections can be completely separated one from the other, and compactly nested, and to provide simple means for drawing the sections together, which means can be quickly and conveniently applied or removed.

EGG-TESTER.—C. F. SWANSON, St. Paul, Minn. The purpose in this case is to provide novel details of construction for a tester, which are simple and very effective in service, affording convenient means for giving mirrors employed any inclination from a vertical position, to reflect rays of light impinging thereon at a proper angle for illuminating eggs held in the tester for inspection.

EGG-LIFTER.—C. F. SWANSON, St. Paul, Minn. The invention relates to lifters employed for lifting eggs in quantity from a crate or the like, disposing the eggs while in the lifter for inspection in a tester device, and after they are tested returning the eggs in proper order within the crate. The object is to simplify and improve the lifter device for which a patent was formerly issued to Mr. Swanson.

FISHING-TOOL.—W. H. BUTTON and E. DYER, Bandon, Ore. This tool is intended for use in fishing out drills and other like devices from oil wells, artesian wells, and other borings. The object of the inventors is to provide a tool of this nature, which will operate to effectively grip tools which have been lost in borings, whether they may be in an upright position or have fallen over to one side.

WINDOW.—S. U. BARR, New York, N. Y. The aim of the present invention is to provide a window which is completely dust proof and air tight, and provided with multiple sashes having interlocking stiles, to give the window the appearance of a stationary muntin sash, but the sashes are capable of being opened and closed although no mullions are used. It relates to such as described in the Letters Patent of the U. S., formerly granted to Mr. Barr.

MATCH-CASE.—W. L. CHAMBERS, Brookville, Ind. The improvement refers to match safes or match cases such as are carried in one's pocket. The object is to produce a case which is simply constructed and which can

be readily operated to produce a single match from the case when desired.

DEVELOPING TRAY. — M. P. Foran, Johannesburg, Transvaal. The tray is for use in holding plates or films while being developed, and is adapted to enable the plates or films to be examined by transmitted light without being removed from the tray, and also to enable the entire operation to be accomplished without requiring the film or negative to be handled by the operator.

CURRENT-MOTOR.—C. A. Neyland, Spokane, Wash. One purpose here is to provide a motor wherein the speed of the current regulates the speed and power of the pump, and wherein also the paddle leaves the water at an acute angle but at opposite inclinations, occupying a position at right angles to the current at mid-stroke, thereby deriving the utmost power from the current at such time.

PIPE-FISHING TOOL.—R. G. Sanford, Yonkers, N. Y. The purpose of this inventor is to provide a form of tool that is under the complete control of the operator at all times, and to so construct the tool that when it is introduced into a pipe and is drawn up by means applied to its body portion, the jaws carried by the body will practically sustain it and so grapple the interior of the pipe or tube as to carry the same upward with it.

PROCESS FOR PRODUCING PORELESS AND WELL-ADHERING ELECTRODEPOSITS.—H. Schmidt, Cologne-on-the-Rhine, Prussia, Germany. This process consists in first providing the metal to be electroplated with a coating of a metal or alloy which melts at a lower temperature than the final electrodeposit, in then electrolytically depositing the final coating, and in melting the intermediate coating.

FOLDING UMBRELLA.—W. Théodore, St. Vincent, Minn. The device is constructed with a telescoping staff, the telescoping members of which are adapted to be positively retained in extended and contracted relations by a sectional nut carried by the inner member, this latter also carrying the ribs, each of which is composed of two sections slidably connected together, with a spring catch for connecting the two sections of each rib when the umbrella is outstretched.

TOOTH-BRUSH CABINET.—G. A. Weidhaas, Jr., New York, N. Y. One purpose in this improvement is to provide a cabinet especially designed to hold tooth brushes, each brush having a compartment for its especial accommodation, and to so construct the device that it will be sanitary, and so that the brushes, while perfectly protected, are readily accessible at any time.

DISTRIBUTING AND CONVEYING BELT. T. J. Carter, Temple, Oklahoma. In operation the pins convey straw and other like bulky substances, while a flight will convey ores, crushed stones, ear corn, saw mill refuse, and other substances, and the belt, with other flights, distribute seed cotton to a battery of two or more gins. An apron is designed for binder elevators and grain belts and separators, and similar apparatus.

COVERING.—J. P. Costigan and J. F. J. Costigan, New York, N. Y. This invention pertains to coverings for boilers, pipes, etc., and its object is to provide a covering easily applied, and arranged to form an efficient nonconductor of heat or cold. It may be made of any length and cut to suit, the cut end of the matrix being sealed by the use of plastic asbestos, magnesia, cement or other suitable material.

SMOKE AND FUME CONDENSER.—J. T. Yates and J. Devey, Lehi, and W. B. Richan and W. A. Devey, American Fork, Utah. The invention is for the purpose of collecting and utilizing the escaping gases from metallurgical furnaces and thereby avoiding injury to vegetation, etc., as well as saving gold, silver, copper, sulfur, arsenic, and other elements usually carried away and lost in the air. It suppresses and disposes of the smoke and gases arising from combustion of coal and other fuel, and avoids the nuisance of such escaping smoke.

RECORD-BOOK.—F. O. King, Aitkin, Minn. The object here is to provide a time book, register, class book, or other book of record, in which may be readily recorded a plurality of names or articles, together with a record of summaries and averages connected therewith arranged on opposite pages.

PLATE-HOLDER.—G. B. Hall, Yarmouth, Nova Scotia, Canada. The object of the inventor is to produce a plate holder of simple construction which will enable plates of various dimensions to be held securely and centrally disposed in the holder. It relates to holders, such as used by photographers for holding photographic plates when placed in the camera.

HAME-FASTENER.—J. W. Gonce, Kinderhook, Ala. The purpose of the improvement is to provide a strong, durable, and satisfactory lever fastener for hames that will act to draw the hames tight and hold them taut, the connection being such that the fastener can be adapted to hames of different sizes.

FOLDING UMBRELLA.—W. C. Wallar, Byesville, Ohio. The invention has reference to umbrellas and the object of the inventor is the production of an umbrella having a simple construction, which will permit it to be readily taken apart and folded for shipment or for packing in a traveling case or trunk.

PROJECTILE.—J. A. Bon, Pavillon 10, Vieux Fort, Vincennes, Seine, France. By its construction this elongated projectile during its movement in the air has its longitudinal axis always brought to the tangent to the trajectory of its center of gravity, on which it takes a position of stable equilibrium, without being necessary to impart to the projectile a rotary motion about this axis. It may be fired in a smooth bore gun or ordnance, or employed for loading a shell, a case shot canister or a sporting or other cartridge.

DRY ORE-CONCENTRATOR.—G. Tolmie, Ogden, Utah. The improvement is especially applicable as a dry concentrator to operate upon ores having a relatively high specific gravity. The concentrator will operate very efficiently to separate the ore or values from the dirt and gangue with which the ore occurs.

CAMERA-SHUTTER RELEASE. — C. C. Little, San Jose, Cal. One purpose here is to provide a device for automatically operating or releasing the shutter of a camera at a known interval after the photographer leaves it, enabling the photographer to appear in the picture taken. Means provide for rendering the device readily adaptable to almost all types and sizes of cameras.

GUN-REST.—J. Jeranek, New York, N. Y. The gun rest is especially adapted for use by sharpshooters, marksmen, and infantry, where very accurate shooting is essential. An object is to provide an adjustable gun rest which can be firmly mounted upon the ground, and which presents a rigid support for the free end of a rifle or other weapon.

Hardware.

SCISSORS.—Esther E. Flyberg, Baudette, Minn. The invention is an improvement in scissors and may be used for ordinary work. When it is desired to cut button holes, the thumb nuts are turned to release the points, when a spring will force them into position for use. By turning a set screw, the length of the button holes may be accurately gaged, the said set screw limiting the closing movement of the blades.

PIPE-WRENCH.—A. B. Heimann, Coalinga, Cal. The improvement is especially adapted for use in the construction of pipe wrenches of unusually large size. More specifically, the wrench is intended to be used for facilitating the laying of line pipes for oil wells, and for screwing and unscrewing the sections of the pipe casing at the well.

AX ATTACHMENT FOR SAWING LOGS.—L. Smith, Myrtle Point, Ore. This invention refers to means for cutting or sawing logs or timber. The object of the improvement is to produce a support or guide for a saw which can be readily attached to a log or timber with ordinary tools. The means afforded are suitable for quickly rigging up a rest for the saw blade which will guide it when working through a log.

GAS AND PIPE CONNECTION.—H. E. Loebe, 49 Greenville Avenue, Jersey City, N. J. The object of this invention is to connect any pipe, and the device can be attached to every description of fittings, such as fire-engines, automobiles, water boilers, etc. No washers are needed. It can be connected or disconnected in one second, and without the use of a tool. It can also be regulated by the screw-cap so that it can not open by any pressure. The system is of a simple and durable construction. An illustrated description of this gas and pipe connection appeared in the Scientific American of February 22.

SASH-LOCK.—J. H. Barton, Brownsville, Tenn. The inventor has in view an improved lock which is adapted to securely lock both sashes at any desired position within the window frame, and which operates to make the window proof against burglars in that the sashes cannot be unlocked after breaking the glass by passing the hand through the window to the lock.

COMBINED AUGER-HEAD AND REAMER. —E. J. Wheeler, Bryson City, N. C. In the present patent the invention has reference to a combined tool adapted to bore a much larger hole in wood or other similar material than is possible with the tool now commonly employed, and in its employment making it possible to bore at one operation, thus saving a second handling.

SHEARS OR SCISSORS.—A. Prohaska, Philadelphia, Pa. The object of this invention is the provision of a new and improved shears or scissors having blades of steel and handles of cast iron, brass, or other metal than steel and arranged to hold the cutting edges of the blades in proper cutting contact with each other.

Heating and Lighting.

HEATING AND VENTILATING SYSTEM. —W. R. Macdonald, Pittsburg, Pa. The object here is to provide means whereby the air may be heated either by an ordinary combustion furnace or by electrical means, and at the same time treated electrically before delivery to rooms. The invention is for use in residences, public buildings, and the like, and relates more particularly to the means for heating and treating the air delivered to rooms.

HOT-WATER HEATER.—J. A. Coppridge and E. W. Coppridge, Richmond, Va. The heater comprises a body and fire pot, the former having a chamber extending around three sides thereof and having the other side of body provided with a door above the pot, the side being provided below the door with a water-back forming one side of the pot and connected with the main chamber, a series of alternating baffle partitions comprising a series of tubes and plates overlying the same, the tubes of the several series being smaller than those of the next lower, and the tubes of the several series connecting independently with the water space of the body.

BOILER.—E. E. Larrabee, Williamston, Mich. The boiler or heater is of a water-tube type, and arranged for generating steam or for use in hot water heating systems for heating the water, the boiler being arranged to utilize the heat units of the burning fuel to the fullest advantage, to provide a large heating surface in a small space, to insure rapid circulation of the water and quick heating thereof for steam generating or for heating purposes.

BOILER-FURNACE.—W. N. Best, New York, N. Y. The invention pertains to improvements in boiler furnaces in which oil is used as a fuel, the object being to provide means not only for the purpose of admitting air requisite for combustion in the burning of fuel, but also to provide means to deflect heat so that no impingement of heat will be deflected against any of the elements of the boiler.

GAS-BURNER.—E. E. Kehnert, Lorain, Ohio. In the present patent the application is a division in part of a former application of Mr. Kehnert's. The invention is an improvement in burners for gas or easily vaporized hydrocarbon oils, the same having certain features of novelty, whereby a superior result is obtained in respect to combustion and calorific effect.

SMOKE-CONSUMING FURNACE. — J. B. Harris, Nashville, Tenn. The furnace is arranged to produce a high heat and complete combustion by the burning of a mixture of air and producer or water gas, the latter being obtained by superheating the steam to dissociation and passing the dissociated oxygen and hydrogen in fine jets into the products of combustion arising from the burning fuel in the fire box, the air being highly heated before entering the box and reaching the gas. The invention relates to furnaces such as shown and described in former patents granted to Mr. Harris.

Household Utilities.

STOVE.—E. C. Cole, Chicago, Ill. The improvement is in draft devices for use in stoves. The check draft admitted through an air inlet cannot get down into the stove, as its outlet or discharge at the upper end will be above the level of the stove, and the entire air admitted as a check will so operate, and no portion of it can pass downward into the stove to operate as a burning draft. Down-draft furnishes surface-combustion whereby to burn the gas and prevent the puffing of the stove from accumulation of gases in the upper part thereof.

AUTOMATIC EGG-BOILER.—L. Leclerc, New York, N. Y. The invention refers to automatic egg boilers, and the object is to produce a device of simple construction not involving a clock movement, which will operate to boil eggs and remove them automatically after the expiration of a predetermined period.

DRUM-TRAP.—P. Ayres, Ocean Side, N. Y. The trap is for use on bath tubs, basins, kitchen sinks, urinals, and like devices, and permits of securely screwing the cover in position on the threaded ring held against the turning in the lead casing, portions of the lead material of the casing extending over the top of the ring to form an integral washer for the cover to rest against, with a view to prevent leakage of gas or other matter.

WINDOW ATTACHMENT.—F. S. Burgess, New York, N. Y. Noise and its consequent discomfort caused by windows shaking in the frame in windy weather is overcome in this invention by providing a keeper having a spring and a bolt movable into the keeper against the stress of the spring; the latter preferably being movable from one side of the keeper to the other, whereby the same keeper may be used at either side of the window.

DRAWER AND DRAWER-SUPPORT.—H. B. Starrett, Clinton, Mich. In this patent the invention has reference in part to a slidable drawer, and in part to an extension slide adapted to support the same and to means for connecting or locking them together. The support is for use in bureaus, desks, and analogous articles of furniture.

MOP-WRINGER.—W. T. Phillips, Los Angeles, Cal. In this improvement, the levers carrying the wringing rolls are pivoted to the vertical standards forming rigid and permanent attachments of a flanged or socketed base adapted to rest in the floor and to receive and support a bucket, or pail, the latter being entirely independent of the wringer.

CLOTHES-DRIER.—J. R. Schmieder, Cincinnati, Ohio. The object of the inventor is to provide a drier simple and durable in construction, and arranged to accommodate a large amount of clothes in a comparatively small space, and to permit of quick folding into a compact form for conveniently storing the drier.

Machines and Mechanical Devices.

TYPE-WRITER.—W. Goerwitz, Berlin, Germany. In this improved carriage feed mechanism, an escapement mechanism defect is avoided, since on the one hand the pinion remains in constant engagement with the carriage rack, and on the other hand the pawl is made to work with a special escapement wheel, so that the ratio of the pinion and the wheel can be proportioned at pleasure without heightening the type-writer and that the teeth of the wheel and those of the two pawls can be large and strong enough to prevent them from breaking.

DESICCATING APPARATUS. — H. Paucksch, Landsberg-on-the-Warthe, Prussia, Germany. According to this invention an agitator is provided between the drying rollers, having arms of a shape adapted to the circumference of the rollers. By this agitator the substance fed between rollers is stirred and simultaneously ventilated and, as a consequence, the parts adhering to the surface of the rollers are prevented from baking on, so that the output of the drying rollers is increased.

OSCILLATING MOTOR.—H. F. W. Falkenberg, 16 Weissenburgerstrasse, Dortmund, Germany. The invention has for its object distributing means for hydraulic machines with an oscillating piston which produces reversal of the distributing slide valve. The latter with its reversing member is arranged in a special casing, into which the water under pressure enters, after partial reversal of the slide valve into the obturating position for the admission of water under pressure has been effected by impact of the oscillating piston, and acts upon the reversing part of the valve whereby it is displaced into its end position.

BOX-CLEANING DEVICE FOR CONCENTRATING-TABLES. — E. H. Shackelford, Salt Lake City, Utah. Concentrates when discharged into a box, tend to settle to the bottom in a tight or dense mass, and the object of the inventor is to provide means to keep the concentrates continuously stirred up or in motion and to move them slowly and gradually to the outlet or discharge pipe, which, with the flow of water supplied to tables will act to discharge the valves through the outlet. The device cleans outlet boxes of vanners, Wilfley tables, and other kinds of tables.

COAL-MINING DRILL-POST.—P. Rommes, Pittsburg, Kan. Of the several objects of this invention one is to provide means for determining the course the drill will take before the post is firmly set and to save labor and time. Another, to prevent the post from giving way when set on a soft or uniform bottom. Another, to afford means for attaching or connecting threaded box of improved pattern, and others of various types and makes. Means quickly and readily shift the threaded box to a higher or lower plane without changing the adjustment of the coupler.

MACHINE FOR FEEDING AND AFFIXING LAUNDRY-TAGS.—F. F. Akerly and W. Borchert, Reno, Nev. The machine insures a continuous automatic feed of tags while any of them are contained in its receiving cylinder and provides a mechanism whereby it can be conveniently and rapidly operated by one individual. It distributes and affixes tags to the articles to be laundered, the tags being those for which Letters Patent were formerly granted to Messrs. Akerly and Borchert.

COMPUTING-SCALE.—W. Peterkin, New York, N. Y. The object of the invention is to produce a scale of simple construction which will operate to indicate the cost of any article weighed, at any price per pound. It constitutes a convenient counter scale to be used in stores or similar places where small quantities or weights of provisions or materials of any kind are to be sold.

PNEUMATIC ACTION.—H. Meyer, New York, N. Y. The invention pertains to self-players, self-playing pianos and like musical instruments, and its object is to provide a pneumatic action which is simple, durable, and compact in construction, to permit its convenient installation above the key board for direct connection with the piano or other action.

ANTIFRICTION GRINDING-ROLLER.—H. Besser, Alpena, Mich. In the present patent the invention has reference to rollers used in mills and analogous grinding devices, the more particular object being to so mount the roller as to give it a maximum efficiency coupled with a minimum of friction.

CONCRETE-MIXER.—H. Besser, Alpena, Mich. The invention relates to machinery for working plastic substances, and more particularly to a type of machine suitable for mixing concrete and other moldable materials used in building. It is sought not only to add an adequate supply of water to reduce the composite material to proper consistency, but further to add a quantity of dry material for taking up excess of water by hydration, for conferring upon the finished material a suitable consistency.

ARBOR.—O. Rose, Crown Point, Ind. The purpose in this instance is to provide means for fastening the spring to the arbor, said means including a form of collet easily placed or removed and which will securely hold the end of the spring without bending or distorting the same. The collet furthermore maintains or does not destroy the true circular shape of the surface upon which the spring

is wound, so there is nothing to make a lump or kink in the spring.

COIN-CONTROLLED APPARATUS. — H. MEYER, New York, N. Y. This apparatus is designed for use on an automatic or self-playing piano, and arranged to allow the use of a single note sheet containing a number of pieces of music, only one of which is played at introduction of the coin, the sheet being automatically arranged at the end of the last piece, to start playing the first piece on introduction of another coin.

OILING DEVICE.—B. H. PADDACK and A. A. DINWIDDIE, Granada, Col. The device is more especially designed for oiling the bearings of shafts, axles, and other machine parts, and arranged to automatically deliver the proper amount of oil to the part of the machine as long as it is running, to stop feeding oil when the machine stops, and to re-use the drip oil.

OIL-CLEANING APPARATUS. — L. W. BROWN, Bakersfield, Cal. The inventor uses the exhaust steam from engine driving oil well as a heating agent for rendering oil limpid and heating and keeping hot a body of water in separating tank, causing sand to mechanically separate and precipitate therefrom; live steam may be used if desired. The apparatus may be connected with an oil well pump and a steam engine and boiler, and to operate continuously and clean the oil as fast as produced from the ground.

PACKAGING-MACHINE.—W. A. FANNING, East Orange, N. J. The aim of the invention is to provide a packaging machine more especially designed for accurately and quickly packaging raisins, currants, and like fruits and products in predetermined quantities and without danger of injury to the fruits or products.

POWER-TRANSMISSION APPARATUS.—C. R. KEITH, Tarrytown, N. Y. The improvement has in view the provision of an apparatus more especially designed for motor vehicles, and in which a driving shaft is adapted to positively drive a driven shaft at more than two different speeds in one direction, as well as positively drive the driven shaft in the opposite direction.

AUTOMATIC BUTTON CUTTING AND SHAPING MACHINE.—W. S. WATSON, Memphis, Tenn. The object in this case is to provide a machine, arranged to accurately cut the button to the desired thickness and at the same time face the button properly, and while automatically and securely holding the shell in proper position to permit of using the shell economically, at the same time producing buttons of high quality. It is such as shown and described in the application for Letters Patent of the U. S., formerly filed by Mr. Watson.

PAINTING APPARATUS.—M. G. BARRIER, Shawnee, Oklahoma. The apparatus is especially designed for painting smoke-stacks or other high stacks on the outer sides, and it is more particularly an improvement upon the machine for which Mr. Barrier formerly obtained Letters Patent. The novel features embodying the improvements are the result of experiments and use and render the original machine practically perfect in operation.

BOILER WASHING-MACHINE. — J. W. SEIFERT, East Point, Ga. The present invention is an improvement upon the machine for which Mr. Seifert formerly received Letters Patent. He has greatly simplified and reduced size, cost, and weight of the original, and increased its efficiency. A great advantage is secured in preventing clothes from coming in contact with the edges of the woven-wire periphery of the drum.

WIND-MOTOR.—D. D. MCINTYRE, Bucklin, Kan. The motor is of that type in which there is no rotating wheel, but the force of the wind is applied directly to produce the oscillation of a frame. To throw out of action, the blades are adjusted and held edgewise to the wind by means of a rope which connects with a shifting lever and extends through suitable guide eyes down through the collar and hollow vertical standard.

SAWING APPARATUS.—E. T. DAVIES, Portland, Ore. The device comprises two pulleys which carry a band saw. The pulleys are mounted in a frame and are adjustable with respect to each other. One of the pulleys is provided with a straining device or tension mechanism which may be regulated at will and which will provide the necessary tension of the band saw.

Musical Devices.

CLARINET.—H. BONN, Jr., Scranton, Pa. In this patent the invention relates to musical instruments, and its object is to provide a new and improved clarinet arranged to enable the musician to easily manipulate the key mechanism for correctly rendering certain tones and trills.

MUTE ATTACHMENT FOR PIANOS.—E. I. PFEIFER, Austin, Tex. This attachment is arranged to permit of instantly changing the piano from an active one to a mute piano and vice versa, and without impairing the touch when the parts are in either the mute or active position, at the same time preventing wear of the action parts by throwing the piano action completely into position of rest during the time the mute attachment is in service.

BELL-PIANO. — J. HAVASSY, Copperhill, Tenn. The object in this instance is to provide an improved bell piano, which is simple in construction and arranged to permit of properly sounding the bells on playing the piano keys, and to damp the bells whenever desired upon actuating a pedal mechanism.

Prime Movers and Their Accessories.

EXPLOSION-ENGINE. — C. L. EDWARDS, Vernon, N. Y. The exhaust valve first opened, the products of combustion escape through the outlet to the outside, the push rod being engaged by a portion of the cam. The piston commencing its forward stroke, the rod is engaged by another portion of the cam, continuing the opening motion of the valve until the top collar thereon engages the inlet valve collar, after which this valve partakes of the motion of the exhaust valve, moving forward to cover the exhaust port, and to move the inlet valve away from the petticoat to uncover opening through said valve, permitting the charge to be drawn into the cylinder by the piston.

INTERNAL-COMBUSTION ENGINE.—R. S. THOMPSON, Chicago, Ill. The invention refers to improvements in internal combustion engines, and more particularly to means whereby an explosion may be obtained in the cylinder at every revolution of the crank shaft and the cylinder completely scavenged of the exhaust gases before each fresh charge is admitted.

ROTARY INTERNAL-COMBUSTION ENGINE.—J. HOKANSON, Newark, N. J. The invention has reference to improvements more particularly to that type of engine in which a separate explosion chamber is provided, into which the fuel charge is compressed and from which it is admitted into the annular cylinder to expand against the piston therein upon the ignition of the charge.

INTERNAL-COMBUSTION TURBINE.—P. KRAUSE, Babylon, N. Y. One of the objects here is to provide a device operating upon the same principle as the common form of steam turbine, but connected directly to a combustion chamber, whereby mixtures of air and a combustible fluid may be ignited and the products of the combustion delivered directly to the blades of the turbine.

Railways and Their Accessories.

CAR-REPLACER.—H. E. MATTHEWS and W. P. MATTHEWS, Salida, Col. The object of this invention is to produce a replacer, formed in such a way as to facilitate its being held in position when in use, and to provide a form for the outside replacer which will facilitate the passing of wheels over the device which have not become displaced from the track.

CAR-STAKE.—F. W. LAWRENCE, Bonner, Mont. The invention refers to stakes for gondola or other flat platform cars, used for carrying timber, scantling, boards, or other freight piled upon the floor. The object is to provide a car stake which renders it light, strong, convenient to apply and remove, and that will enable the quick folding of the stakes on the side of the car, for affording access to material on the car that is to be unloaded.

HAND SIGNALING-LANTERN. — E. M. TOMLINSON, Castle House, Petersfield, Hants, England. The construction of the lantern is such that merely by sharply twisting the hand which holds the lantern, the frame carrying the different colored glasses will be caused to rotate, relatively to the lantern body, through a definite angle, and may at each such operation bring a different colored glass into registration with the bull's-eye of the lantern.

GRAIN-CHUTE.—A. G. YOUNG, New London, Conn. The chute is adapted for drawing grain from a car and delivering it into sacks or other receptacles to be weighed, the construction of the chute being such that it can be quickly and conveniently applied to a grain door and as expeditiously and readily removed, thus obviating the shoveling up the grain to provide room within the car for scales.

CAR-MOVER.—V. GUSZTÁV, Vienna, Austria-Hungary, 1, Schottenring 25. In the present patent the invention has reference to a device for moving cars upon tracks, which is designed in such a manner that the handlever may be swung laterally in order that the person using the car mover may stand either between or outside of the track.

LOCOMOTIVE FLAG-SIGNAL AND CASE. —J. P. LYON, Ogden, Utah. The invention relates to the classification flag signals ordinarily carried by locomotives and consists in a case designed to be carried upon the front part of the locomotive between headlight and smokestack, and a set of metallic flags carried thereby and arranged to be housed within the case or displayed on each side of the case as required, the case and flags being especially designed and related to each other.

AUTOMATIC RETAINING-VALVE. — C. MARTIN and M. BEASLEY, Dickson, Tenn. The invention refers to fluid pressure brakes of the Westinghouse and like types, and its object is to provide a valve, arranged to retain the pressure in the brake cylinder while recharging the auxiliary reservoir, thus preventing the acceleration of the train, especially when running down a steep grade.

HAND-CAR.—J. W. FINCH, Elizabeth, Miss. The object in this case is to provide improved means for driving a hand-car, particularly with respect to the driving connections between the rocking or working lever and a planetary gearing from which motion is transmitted to wheels.

GRAIN-CAR AND DOOR THEREFOR.—H. ALSOP, Chicago, Ill. More particularly the invention relates to the sliding doors of grain-cars and means for mounting said doors, its object being to provide an efficient closure for the usual door opening, whereby grain may be stored in the car and prevented from leaking out, and also to provide means for opening the doors and discharging the grain from the car.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Minerals sent for examination should be distinctly marked or labeled.

(10675) W. J. H. asks how to give tin a crystalline appearance. A. The *moiré métallique*, or crystallized tin plate, is much used for trunks and fancy articles, and is usually prepared from well-annealed and well-tinned charcoal iron plates, by rinsing the plates with dilute nitric or nitro-muriatic acid, and then with water. The cleansed plates are dipped for a few moments in nitric acid, 1 part, and muriatic acid, 3 parts, diluted with 1 to 3 volumes of water and heated to about 180 deg. F., and after a short exposure, rinsed in running water. Repeat, if necessary, until the crystals are properly developed; then rinse in hot water, and dry in the air. Then oil or lacquer. Hot tannin or caustic soda solutions may also be used to develop the crystalline structure.

(10676) R. S. P. asks: 1. Will you tell many inquirers the chemical combinations which take place in the burning of greasy rags and which cause fire (spontaneous combustion)? A. When wet paint dries, as it is called, the paint in reality hardens by the combination of oxygen from the air with the oil of the paint. It is not a drying process, such as takes place in a cloth wet with water by evaporation, but is in reality a combustion of the oil by chemical combination with oxygen. This is of course then a heat-producing process, just as really as when the oil is ignited and burns with a flame in the air. The only difference is in the slowness of the combination with the oxygen. When the oil is absorbed in loose rags, it is spread out so much that it comes more readily and extensively into contact with the air, and the heat is produced much more rapidly, so rapidly in many cases as to ignite the rags. This is what takes place in so-called spontaneous combustion. 2. Is there anything known to science that could be put in a closet or refrigerator that would reduce the temperature? A. Ice is the only common substance used for refrigerators to reduce the temperature. Nothing is known which can take its place economically.

(10677) J. R. P. says: Please answer this question in physics for me, quoting reference. A ball thrown 300 feet perpendicularly into the air goes faster at any given point on the way up than at the same point on the way down. If in a vacuum, what would be the case? A. A ball thrown vertically upward to a height of 300 feet must leave the ground with a velocity of about 138 feet per second. This is computed from the formula $S = \frac{1}{2}gt^2$, for which see any textbook of physics. We have only taken an approximate value. At this velocity the frictional resistance of the air is appreciable, and the ball will be retarded in its rise, so that it will not reach the theoretical height of 300 feet, unless it starts with a somewhat higher velocity than the theoretical velocity. How much we do not know with exactness. Its return will therefore be from a lower altitude than its initial velocity would require it to attain. Therefore its actual velocity at any point of its return will be less than its velocity at the same point of its ascent. In a vacuum there is no retardation by the air, and theoretical conditions will be realized. A body will rise to the full height given by the formula above, and on its return attain the same velocity as it had at the same point of its ascent. Almost any textbook of Physics may contain these points. You may refer to Millikan and Gale, pages 25 to 31.

(10678) C. J. C. asks: A maintains amber is non-inflammable, and will not burn, and B maintains amber is inflammable and will burn. Who is right, A or B? A. Amber is a fo il gum, known in mineralogy as succinite. It is a compound of carbon, oxygen, and hydrogen, as are all vegetable resins and gums. It will therefore burn. It does burn with a yellow flame leaving a carbonaceous residue.

(10679) J. H. E. states: I have observed that in printing from a plate in photography a plate prints quicker by a number of seconds when it is new than when it has been developed several months. Will you please tell me the reason? Is it through the darkening of the $AgNO_3$ in the plate? A. It may be the plate was insufficiently washed after fixing, which gave it a slight yellow tinge, or that the grade of paper was slower than the previous brands used. The reduced silver does not darken any more than the grade given it by the developer.

(10680) J. N. B. and several others ask: Will you please publish in the Notes and Queries column the best way for reviving worn-out dry batteries? A. The best treatment for worn-out dry cells is to throw them away. They may be made to give some current for awhile by making a hole in the top of the cells and filling them with a strong solution of ammonium chloride in water.

(10681) W. R. R. says: Would you please answer through your Notes and Queries column how to get the true north and south at night by the polar star? A. The way to find the true north and south by the pole star is to get from the Ephemeris the time of night when the pole star will be due east or west of the pole, and be ready to set the transit upon it when in this position. After this set off its north polar distance, and drive pins in the line of the transit telescope. This will give a true north and south line. A very much simpler way is to get the magnetic variation of your place for the year from the United States Geodetic Survey, Washington, D. C., and allow for this on the magnetic needle of the compass. The declination of Chequamegon Point, near you, in 1902, was determined by the Survey as 5 deg. 6 min. east. Perhaps this is accurate enough for your purpose.

(10682) J. J. McD. says: Will you please inform me as to whether or not an object incased in a vacuum, at a greater or less degree Fahrenheit than the surrounding atmosphere, would retain its thermometrical identity? A. A substance in a vacuum hotter or colder than the surrounding space will retain its temperature better than when exposed to the air. In other words, a vacuum is as good an insulator for heat as any we have. There is no complete insulator for heat.

(10683) H. M. says: I would like to find out what is the work of a graduate electrical engineer. It seems to be difficult to find out anything further than that he is employed by traction companies, construction companies, etc. But what I wish to know is, in what different ways may he be employed by companies or otherwise, and what does he actually have to do? A. An electrical engineer oversees and supervises any sort of electrical work which the company employing him wishes him to oversee and supervise. He may design electrical machinery and direct its construction, or install the machinery sold by the company in any part of the world. He is sent to any part of the world in which his employers may have business to attend to the furthering of that business. You may see him attending to the repair of a broken trolley wire, or taking ca.e of a burn-out on a trolley car. He may look after the construction of a track or line, and conduct the tests of it when finished and ready for service. One was killed in the subway near your Borough Hall the other day as he was setting the connections of a transformer to rights, when the tubes under the river were about to open. His is a diversified calling. He is not often seen in fine clothes in working hours, and his hours are day and night alike.

(10684) J. W. P. asks: What metal is next best to platinum for contact points on gas engine spark coils and where or how may I obtain it? A. There is no metal which can take the place of platinum as contact points for a gas engine igniter. All other metals oxidize so rapidly that they are worthless for this purpose. Copper or iron may be used for a short time.

(10685) C. E. and others: A large number of inquiries have been received for the name of the firm employing *college* graduates for a small compensation while they learn the practical part of electrical engineering. We may say that it is quite the general practice of the larger manufacturing concerns to take in such men and train them for their needs. Locomotive works do this. In the electrical line, all the larger companies have special arrangements of this kind. Our correspondents may apply to the General Electric Company, Schenectady, N. Y., or the Westinghouse Electric Company, Pittsburg, Pa., or the Thomson-Houston Company, Lynn, Mass. If there is a large company near the home of any young man desiring to do this work, he may apply there. Probably he will find some system of employment of the sort indicated in operation.

(10686) J. R. B. asks: A discussion arose this morning regarding the following matter, and as we could not arrive at a satisfactory solution, decided to ask if you would kindly explain the matter in your magazine, to which the writer is a subscriber. The month of February this year has five Saturdays since the month has twenty-nine days, being leap year, and the first falls on a Saturday. It was found by computing ahead that it would be twenty-eight years before this same state of affairs would happen again, or in 1936. We found by computing backward that it was but twelve years since this had occurred before, or in 1896. Now the difference is caused doubtless by the end of the century coming, in which even year, namely 1900, no leap year or extra day in February occurred. The question is, why should this make this particular difference, and why should there always be twenty-eight years between these occurrences, excepting when an end of a century is reached? A. Ordinary years have fifty-two weeks and one day, hence January first occurs one day later each successive ordinary year. If there were no leap years, there would be but seven possible calendars, one for years beginning on Monday, one for years beginning on Tuesday, etc., for the seven days of the week, and these would follow each other in regular order. The introduction of the leap year adds seven other calendars for the leap years with January beginning on each of the seven days of the week. And for that reason February would begin upon a stated day once in 4 x 7 or twenty-eight years. Further complication of the calendar is produced by the omission of all centennial years from the leap years unless they are divisible by 400. So from 1600 to 1999 the centennial years are not leap years and seven years come between two leap years. This destroys the 28-year sequence. The Ladies' Home Journal for January, 1908, contains these fourteen forms and a table giving the years for 200 years, from 1776 to 1978, with the proper calendar for each. This table can easily be extended, and the sequence of the recurrence of a given day of the week, as the 29th of February, developed. There appear to be three intervals, of 12, 29, and 40 years, between the Februaries beginning with the same day of the week and at the same time leap years, so that there are five of the same days in February. In the case of five Saturdays, 1772 to 1812 were forty years, from 1896 to 1908 were twelve years. As 2000 is a leap year there are twenty-eight years from 1992 to 2020, the next occurrence of five Saturdays in February. All other intervals are twenty-eight years.

NEW BOOKS, ETC.

Les Oscillations du Matériel des Chemins de Fer et la Voie. Stabilité des Automobiles. Par Georges Marié, ancien élève de l'Ecole Polytechnique, Ingénieur, chef de Division des Chemins de fer de P.-L.-M. en retraite, Membre de Comité de la Société des Ingénieurs civils, Lauréat de l'Institut de France en 1895 et en 1906.

5 volumes containing 379 pages, with 68 figures.

I.—Les dénivellations de la voie et les oscillations du matériel de chemins de fer. 142 pages, 26 figures. 4 fr.

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The first four volumes, highly praised by the Académie des Sciences in December, 1906, and representing the scientific study, from an entirely new point of view, of oscillations of materials at high velocity and the derailments that can result from them, form a splendid series of works on this most important subject.

In the first volume, taken from the Annales des Mines, the author treats of oscillations due to variations of level in a roadway, showing the part that the resonance of successive oscillations plays, and explaining their additive character, caused by the blades of the springs and other passive resistances. It shows that the best material is that which can without danger go over badly-constructed roads at the highest speed. He establishes formulas which allow the different elements governing vehicles to be calculated so as to obtain this result.

The second and third volumes, taken from the Mémoires de la Société des Ingénieurs, received, among other things, a gold medal from the Society. They deal with the oscillations due to horizontal defects in the roadway. The author shows that at the highest oscillation the tendency to derailment is much more considerable than one would suppose from the ordinary calculations of centrifugal force.

In the fourth volume, from Revue générale des Chemins de fer, the author explains the oscillation due to the moving and turning parts, not in equilibrium, of locomotives, and under the action of steam. He shows that the violence of oscillations of locomotives due to diverse causes grows with the speed, and is much more considerable than the old theories would make one suppose.

In the fifth volume, the author first of all establishes a new theory of stability in automobiles, which is founded on a formula giving the condition that the automobile ought to fulfill so that it should remain upright instead of upsetting when acted upon by sharp unbalanced forces. Then he shows that all the theories, formulas, and graphical dynamical curves of these first four volumes can be applied to the study of stability in automobiles.

Men Who Sell Things. Observations and Experiences of Over Twenty Years as Traveling Salesman, European Buyer, Sales Manager, Employer. By Walter D. Moody. Chicago: A. C. McClurg & Co. 12mo. Price, $1.

A book of advice to salesmen, but containing advice applicable to almost any kind of business activity.

Steel Construction. A Practical Treatise on the Modern Use of Steel in the Erection of Fireproof Buildings, and its Application to Structural Work in General. By Edward A. Tucker. Chicago: American School of Correspondence. 8vo.; cloth; 308 pages; illustrated. Price, $1.50.

Another volume in the series of practical text-books which this school is publishing at a very moderate price.

Science of Nature History. By Nasawanji Jiovanji Readymoney. Bombay, India: The Times of India. 8vo.; cloth; 103 pages. Price, $1.50.

An ingenious and seemingly complete system of classification of the universe, based upon relative age or position measured from some common starting point. Although the author's style is rather involved, his work should be met with approval by those who are interested in the subject.

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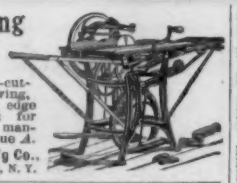

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Scientific American Supplement 1538 gives the proportion of gravel and sand to be used in concrete.

Scientific American Supplements 1567, 1568, 1569, 1570, and 1571 contain an elaborate discussion by Lieut. Henry J. Jones of the various systems of reinforcing concrete, concrete construction, and their applications. These articles constitute a splendid text book on the subject of reinforced concrete. Nothing better has been published.

Scientific American Supplement 997 contains an article by Spencer Newberry in which practical notes on the proper preparation of concrete are given.

Scientific American Supplements 1563 and 1569 present a helpful account of the making of concrete blocks by Spencer Newberry.

Scientific American Supplement 1534 gives a critical review of the engineering value of reinforced concrete.

Scientific American Supplements 1547 and 1548 give a resume in which the various systems of reinforced concrete construction are discussed and illustrated.

Scientific American Supplement 1564 contains an article by Lewis A. Hicks, in which the merits and defects of reinforced concrete are analyzed.

Scientific American Supplement 1551 contains the principles of reinforced concrete with some practical illustrations by Walter Loring Webb.

Scientific American Supplement 1573 contains an article by Louis H. Gibson on the principles of success in concrete block manufacture, illustrated.

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Scientific American Supplements 1575, 1576, and 1577 contain a paper by Philip L. Wormley, Jr., on cement mortar and concrete, their preparation and use for farm purposes. The paper exhaustively discusses the making of mortar and concrete, depositing of concrete, facing concrete, wood forms, concrete sidewalks, details of construction of reinforced concrete posts.

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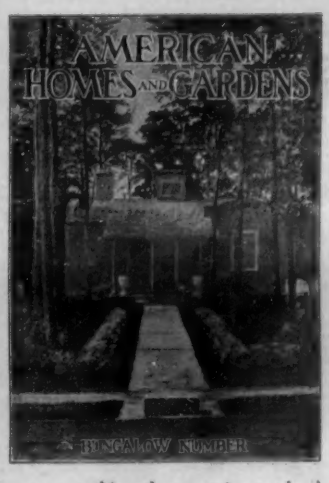

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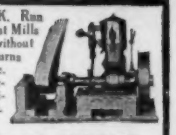

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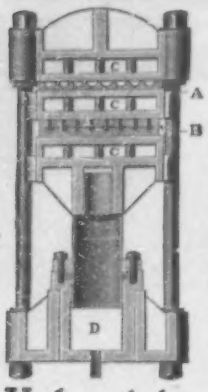

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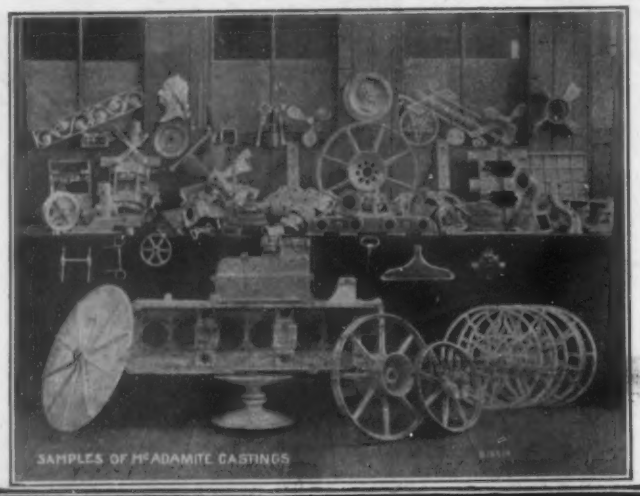

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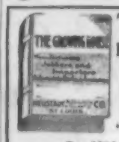

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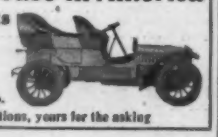
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